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November 2025
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AEROPLANE

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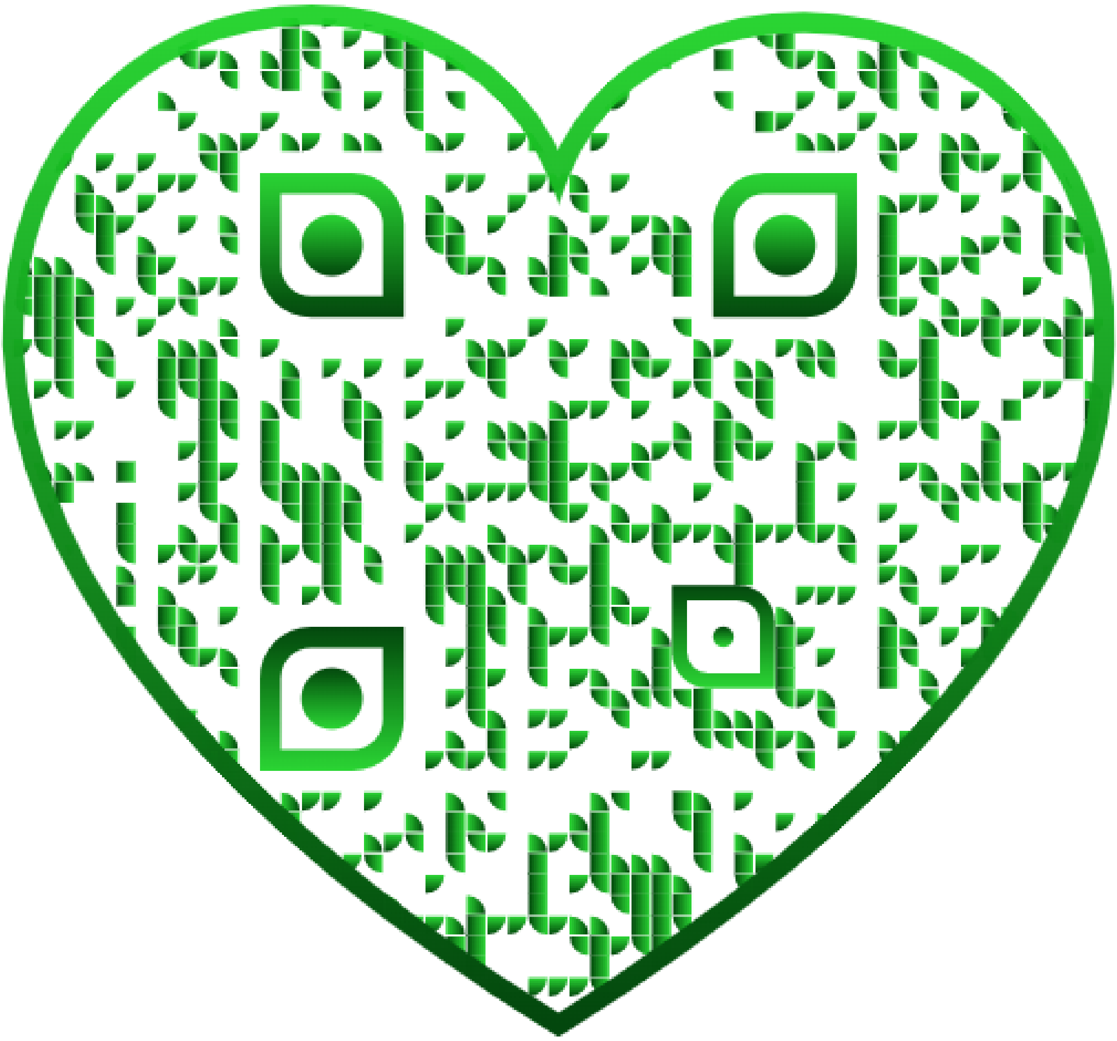

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DATABASE
DOUGLAS DC-8

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COVER IMAGE:
Tony Agar's Mosquito NFII, HJ711, engine-running at East Kirkby. DARREN HARBAR

From the Editor

CONNECT WITH *AEROPLANE*...
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What a week of historic aviation it was. Within seven days, I and others were privileged to witness eight Hurricanes and an Anson I flying at Duxford, the Anson again in Jersey, and a Messerschmitt Bf 109 E at the Hahnweide. It only proved possible to stage the Hurricane octet once, as the Letecké Muzeum Tocná machine had to depart on Saturday to avoid potentially bad weather en route home, but hopefully there will be other opportunities. Indeed, there would have been 10 in the formation had not the BBMF's pair been forced to withdraw, so there should exist chances to bring such a 'Balbo' into double figures.

The Anson I is a masterpiece. What a tribute to the restoration carried out in New Zealand by Bill Reid, and to RAF Station Czechoslovakia for stepping forward to buy this British classic when Bill decided to sell. Owner Richard Santus went to great efforts to make both Duxford and Jersey; everyone who saw it will have appreciated them.

And what about the Hahnweide, location for the show debut of that gorgeous 'Emil'? I have been three times to this great German occasion, and I truly could not say which the best was. Suffice to say, it again hit the spot in a way few other events quite manage.

Such treats were enough to cause one temporarily to forget the latest decisions by certain national museums, headlined by the last Comet 1 leaving the RAF Museum's collection and heading to St Athan, where it will be displayed in an incomplete form. As with the Northern Ireland-bound Chipmunk last month, no criticism is directed at the Comet's destination — the South Wales Aviation Museum is doing a tremendous job at stepping in to rescue aeroplanes that otherwise would struggle to find a home. Rather, it's the manner in which one of the most significant large airframes in the country should have been neglected by a national museum for so long that losing its wings became inevitable. And while an aeroplane that had no actual RAF history — Lightning missile trials use notwithstanding — cannot be considered a core RAFM collection member, I fundamentally believe one of our national museums should set a higher standard in preserving such a significant artefact.

It is a shame discussion of questionable museum policy decisions, like the IWM's closure of the Lord Ashcroft medal collection, tends now to be dominated by accusations of 'political correctness', 'wokery' or similarly nebulous concepts that are thrown around at will, rather than there being a meaningful debate around the choices made by taxpayer-funded institutions. For it is necessary to hold public organisations to account, and, sadly, it appears there's an increasing need to do so. What a delight, then, that the activities of private historic aircraft owner/operators are still able to offer such a tonic.

Finally, some very sad news as we mark the passing of two contributors. Our regular Swedish author Jan Forsgren died in September. One of our very best and most valued writers, an outstanding expert on Swedish aviation and much else, Jan's writing and research will be sorely missed indeed, though you will continue to see it as we publish a number of features written before his death. And the same month we lost Roger Beazley, former head of experimental flying at RAE Farnborough, director of research and development flying for the MoD, and very active in air display supervision. He had written for us on RAF Germany Lightnings and a round-the-world flight in Farnborough's Comet 4, and was a greatly appreciated source of advice to me in writing editorials on airshow safety. Many condolences to their family and friends.

Ben Dunnell

CONTRIBUTORS THIS MONTH

GUY ELLIS

Guy has been researching and writing about aviation and general history for more than 30 years. A fascination with the past and an innate inquisitiveness has resulted in several books, numerous articles, a website, talks and a degree in history. All of this has come about with the input and help of many very interesting and generous people. He continues to research and document little-known events with an emphasis on talking to those who were there.

DAVID RANSTED

David has worked in the aviation industry for most of his career in a variety of commercial roles. While he has an avid interest in all things aeronautical, his passion is for the history and heritage of airlines, airliners and airports. He has written many articles for Key Publishing titles *Airliner World*, *Aviation News* and *Airports of the World*, and compiled his first Database for *Aeroplane* last year on the Lockheed TriStar. Now he adds his second, the subject the Douglas DC-8, helped greatly by a range of ex-DC-8 pilots.

IAN THIRSK

Following a 32-year career with the Royal Air Force Museum, Ian Thirsk retired as head of collections and research in 2021. He maintains a lifelong volunteer association with the de Havilland Aircraft Museum, where he today heads the Mosquito conservation team. Encouraged and mentored by the late Stuart Howe, Ian developed a keen interest in the Mosquito, and not least prototype W4050, whose life and times he has researched extensively.

NICK WATERS

Nick's father worked at RAE Farnborough. This, and the regular airshows there, sparked his early interest in aviation. He joined Rolls-Royce in Derby as an engineering apprentice and worked there for nearly 40 years, his career including engine performance, health management systems and service support on the RB211 and Trent engine programmes. Since retiring, he volunteers as a guide at the Rolls-Royce Heritage Trust exhibition in Derby.

AEROPLANE
ESTABLISHED 1911

Aeroplane traces its lineage back to the weekly *The Aeroplane*, founded by C. G. Grey in 1911 and published until 1968. It was relaunched as a monthly in 1973 by Richard T. Riding, editor for 25 years until 1998.

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News

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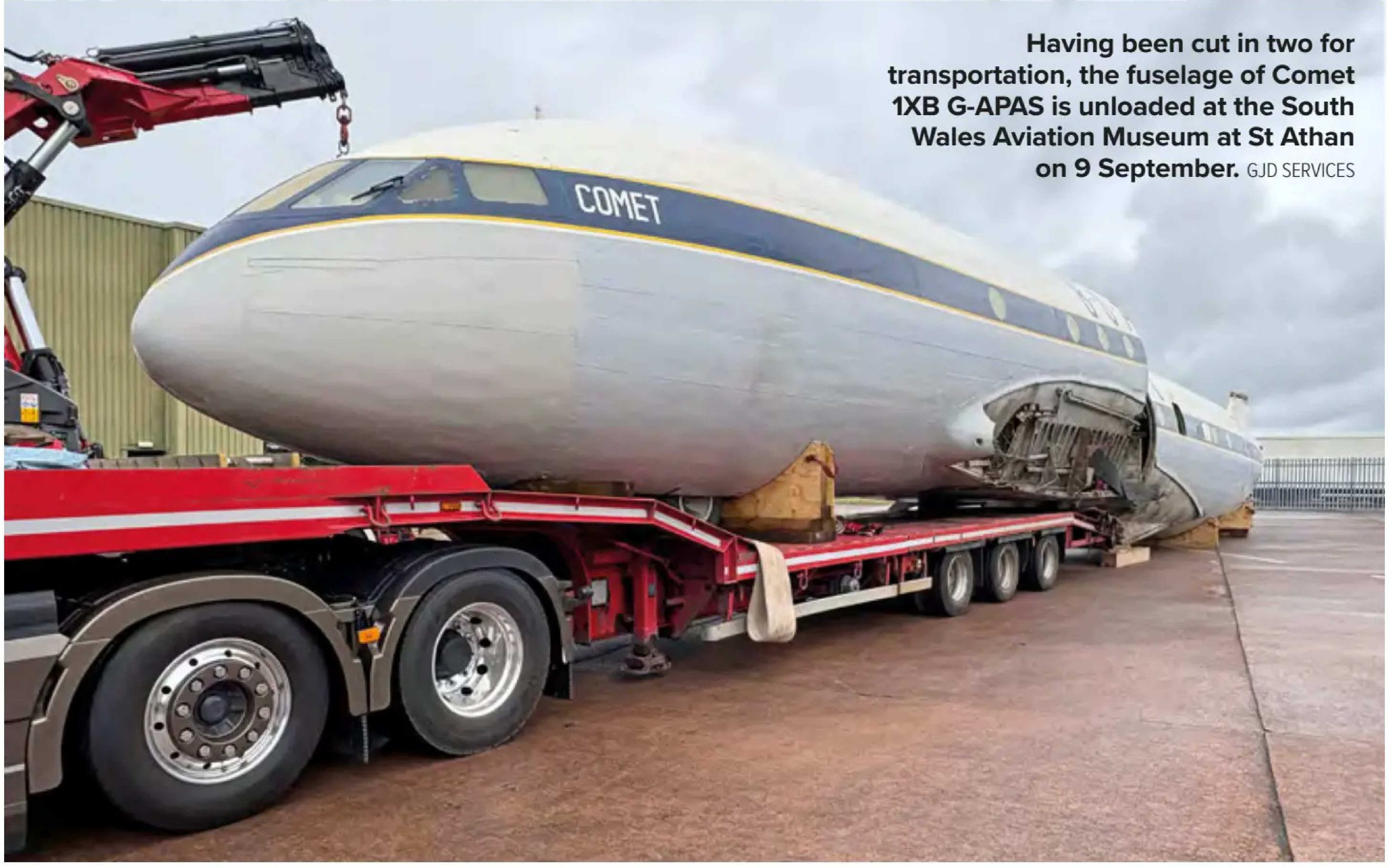
Comet 1 leaves Cosford



Having been cut in two for transportation, the fuselage of Comet 1XB G-APAS is unloaded at the South Wales Aviation Museum at St Athan on 9 September. GJD SERVICES

The fuselage of the last surviving short-fuselage de Havilland DH106 Comet 1XB, G-APAS, left the RAF Museum Midlands at Cosford on 9 September heading for a new home with the South Wales Aviation Museum at St Athan. Although the wings have also been moved to Wales, severe corrosion means they will never be reattached to the fuselage, so, to all intents and purposes, the early-configuration Comet as a complete entity is now a thing of the past.

After repeated requests to the RAF Museum for details, the following statement finally arrived on 16 September: “The transfer of the Comet out of the RAF Museum’s collection was approved by trustees in January 2025. This was an outcome of the museum’s ongoing Collection Review conducted in conjunction with future display planning.

“This variant of the Comet was never operated by the RAF. The ex-Air France/Ministry of Supply airframe carries a false civilian BOAC livery. The Comet is represented by 950 other items in the collection (including library, archive, photographs, film and sound, and fine art). Despite making a national offer for gifting the Comet, no interest was received. The museum, therefore, directly approached the South Wales Aviation Museum in St Athan, Vale of Glamorgan with the offer which was accepted. It will be placed on public display and its story shared with future generations. The South Wales Aviation Museum was established to preserve aviation heritage and to inspire the next generation of aviators and engineers. It is the largest independent aircraft museum in Wales.

“As part of the condition assessment required before the move, it became clear that there is severe corrosion to parts of the airframe which will not survive relocation. It is likely that this was caused by the airframe being stored outdoors for many years before being brought into Midlands Hangar 1 in 2006. It was, therefore, necessary to remove the aircraft’s wings, disposing of any material that is beyond salvage. This will result in the display of the fuselage section only at the South Wales Aviation Museum.

“Any material removed because it cannot be salvaged for heritage use will, where possible, be reused in commercial products to support the South Wales Aviation Museum [to] meet display costs for the Comet. This will help ensure the ongoing sharing of the Comet story after every other option had been exhausted.”

The machine was the last of 21 Comet 1s to be built, making its maiden flight at Hatfield on 16 March 1953. It was delivered to Air France on 22 July as F-BGNZ, being withdrawn from service on 11 January 1954 when the BOAC Comet fleet was grounded for inspection following the catastrophic loss of G-ALYP over the Mediterranean off Elba the previous day.

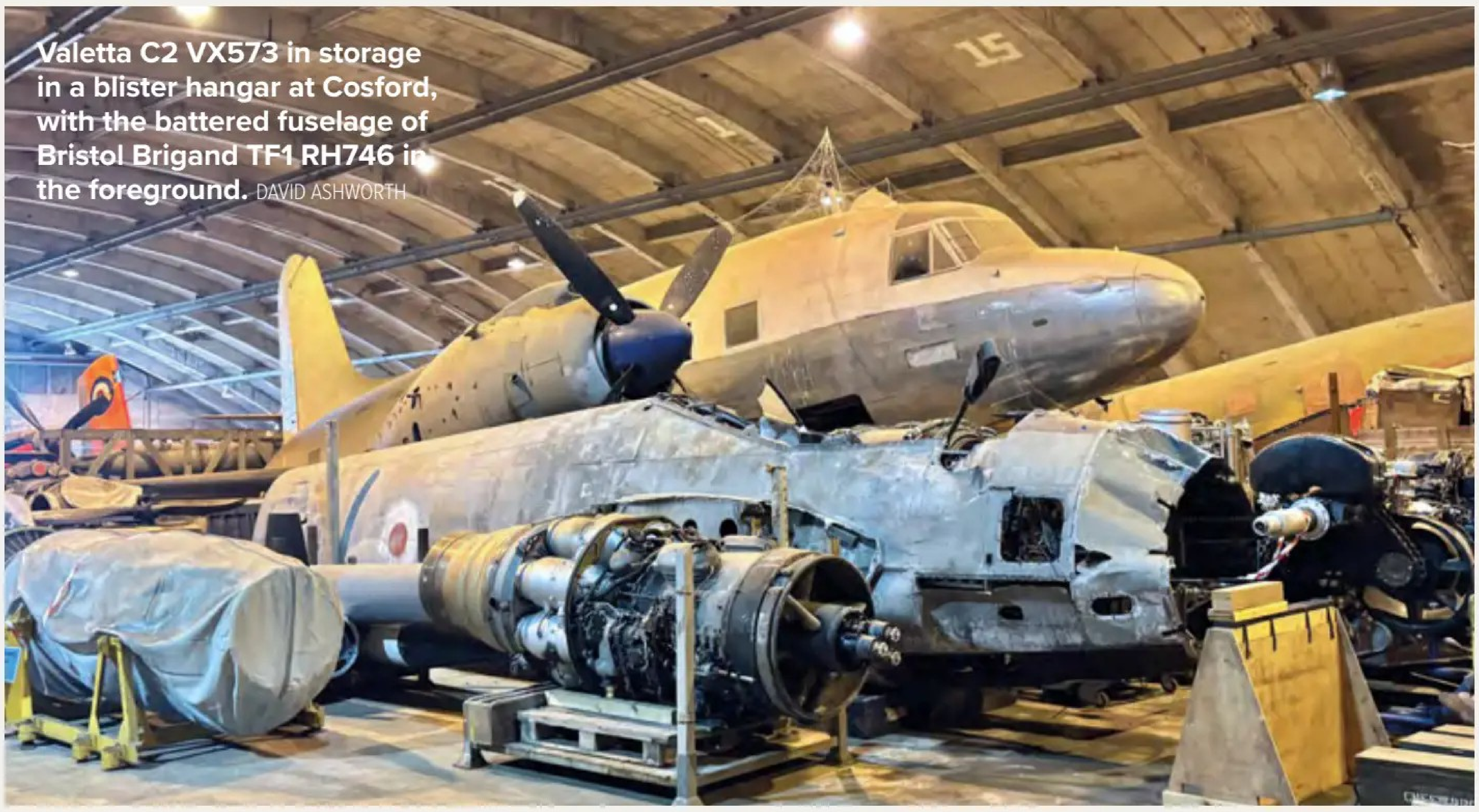
On 18 February 1954 it was returned to the manufacturer at Hatfield for modifications before going into storage. In September 1956 it went to Broughton, Chester for a conversion programme, becoming a Comet 1XB with a strengthened fuselage, rounded windows and various other modifications. Registered to the Ministry of Supply as G-APAS on 29 November 1957 it went on to fly on trials and research work into infra-red weapon programmes, initially for the Red Top and Firestreak air-to-air missiles, much of its trials life being conducted wearing an RAF Transport Command-style colour scheme. Struck off charge on 23 February 1968, approval was soon given for transfer to the RAF Museum. It departed Hatfield on 8 April 1968 for Shawbury where it went into storage.

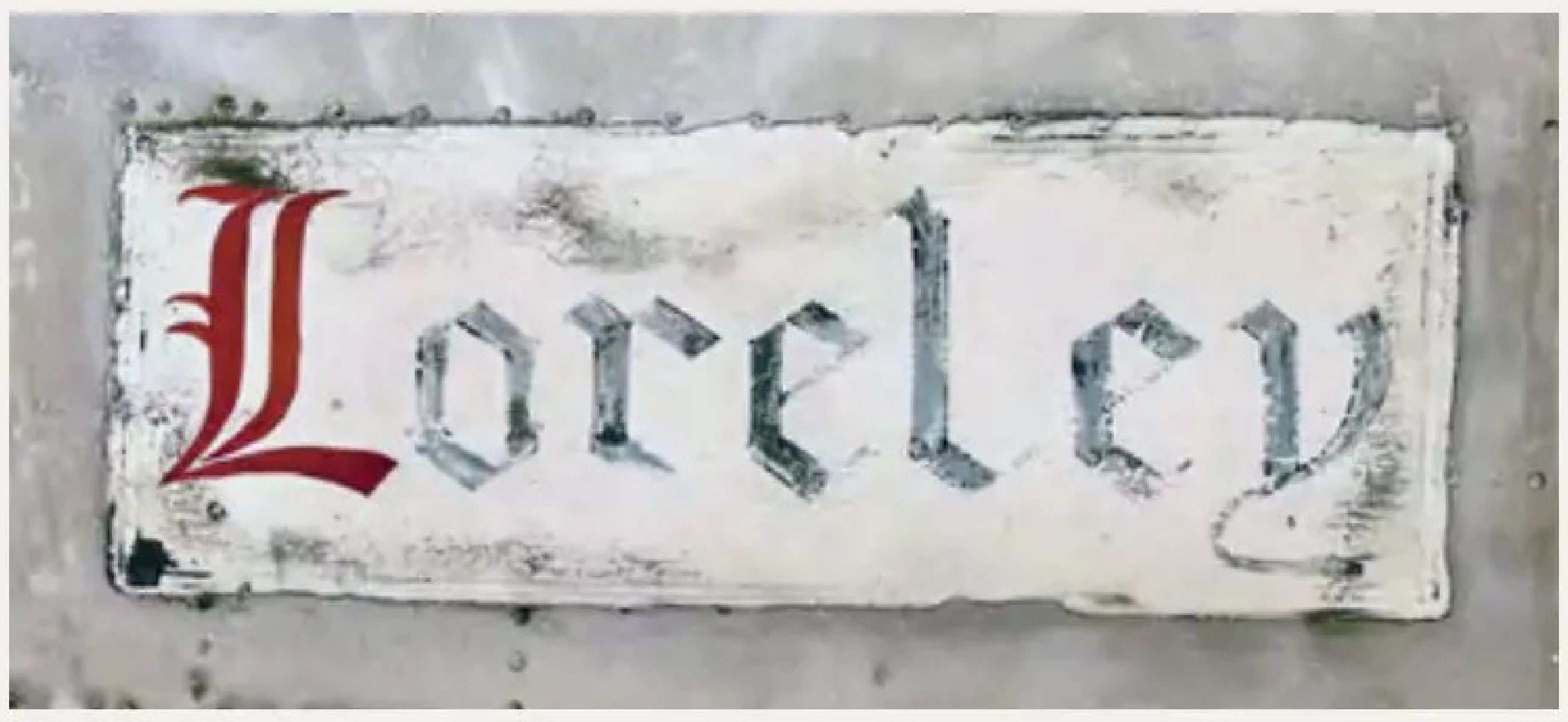
During July-August 1978 the Comet was dismantled for movement and repainted in a full BOAC livery by British Airways engineering staff from Heathrow. It was transported the short distance from Shawbury to Cosford on 17 September 1978, after which it suffered years of neglect.

Valetta for Blackbushe

Scheduled to join Vickers Viking G-AGRW *Vagabond* at Blackbushe Airport next year is an example of the military variant of Britain's first post-war airliner, Vickers Valetta C2 VX573, whose donation to the Blackbushe Heritage Trust by the RAF Museum was announced in early September.

Built during 1950 at Brooklands, VX573 served as a VIP transport for the commander-in-chief, Royal Air Force Germany during in the 1950s and 1960s. It was named *Loreley* referring, rather oddly, to a siren in German mythology who sits on a rock on the Rhine using her beauty and song to distract sailors and cause them to wreck their ships.


Valetta C2 VX573 in storage in a blister hangar at Cosford, with the battered fuselage of Bristol Brigand TF1 RH746 in the foreground. DAVID ASHWORTH



The name *Loreley* is still visible under the cockpit on the Valetta's starboard side. DAVID ASHWORTH

"We are thrilled that Blackbushe Heritage Trust has been successful in our bid to acquire the Valetta from the RAF Museum", says the BHT's Kevin Bond. "This aircraft was a regular at Blackbushe in the 1950s while serving with the RAF, before being retired in July 1968. It was placed in hangared storage at RAF Cosford just a few years later and has remained there ever since. Its remarkably good condition means that when we move the aircraft to Blackbushe next year we anticipate being able to welcome members of the public on board very soon afterwards.

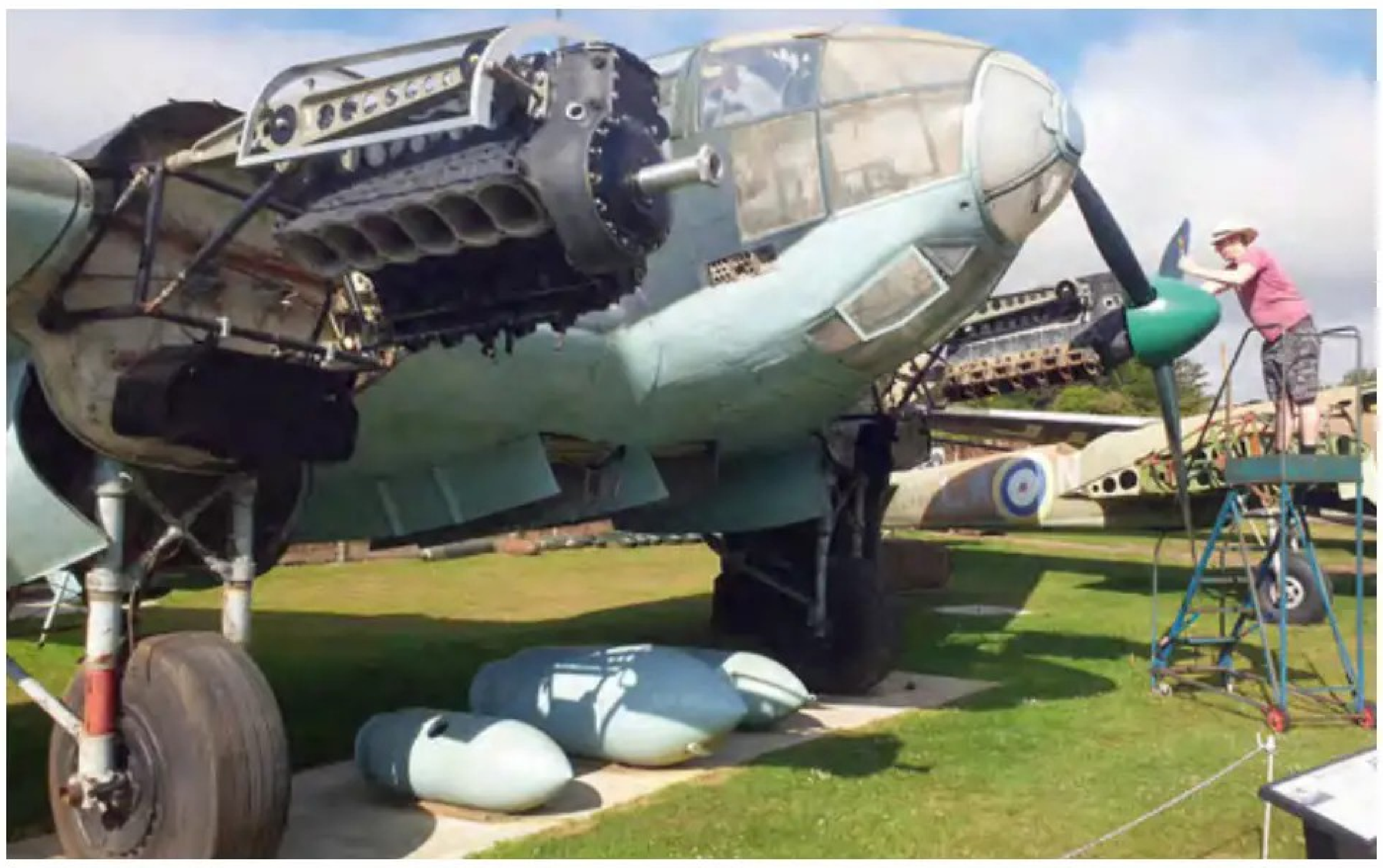
"It will also be extremely useful to use the airframe as a reference as we progress the restoration of the Viking *Vagabond*. Both airframes are very similar, the differences being that the Valetta had a double cargo door, a stronger cabin floor and more powerful engines. Quite a bit of work is still required but we hope the aircraft will arrive at Blackbushe next summer and become the second aircraft in our fledgling collection."

Hawkinge Heinkel advancing

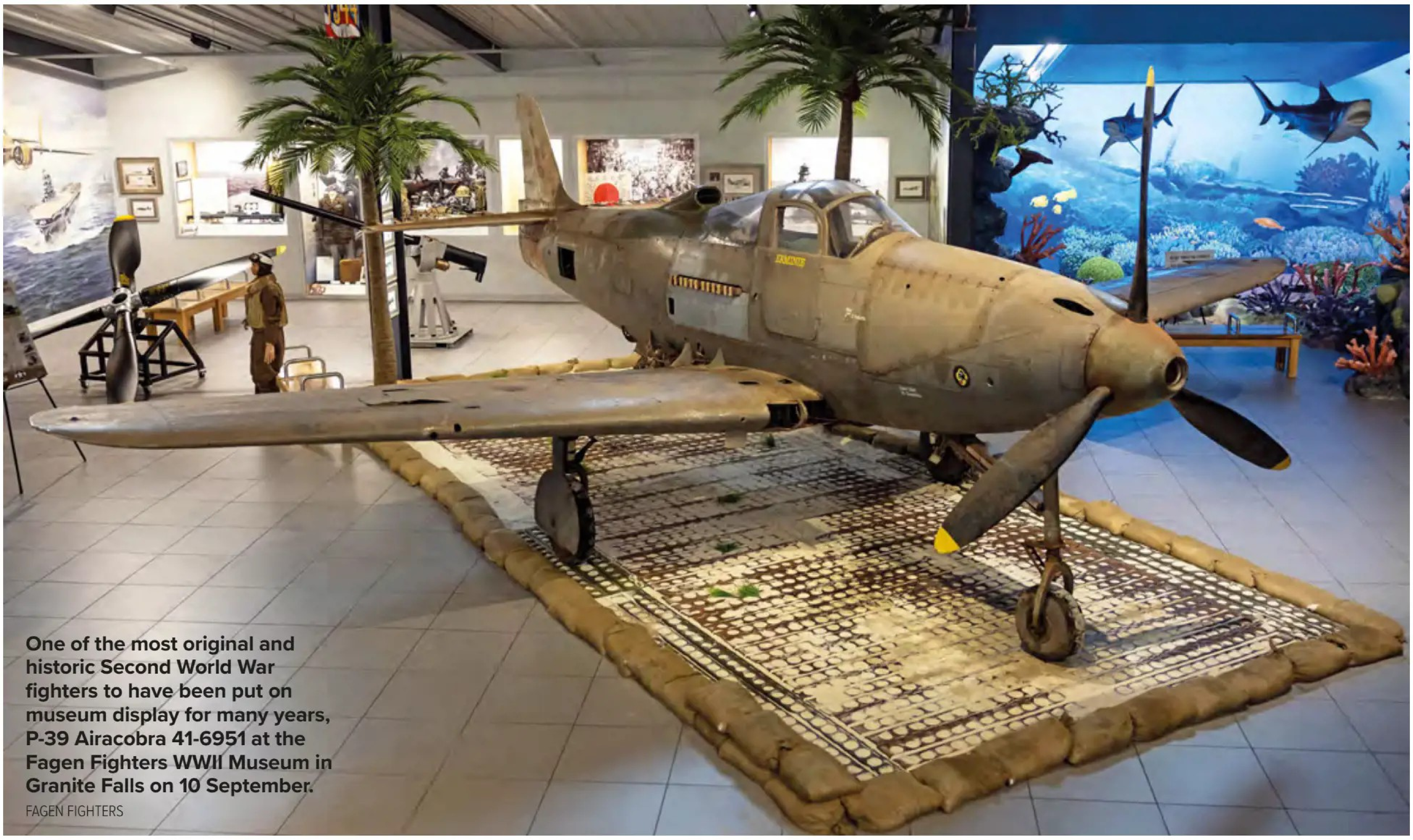
At the Kent Battle of Britain Museum at Hawkinge, the restoration of CASA 2.111B B.2I-103 continues apace, with newly fabricated exhausts being fitted to the Jumo 211 engines by the end of August. The exhausts have been built by Peter Smith using photographs, diagrams and drawings, supplied by the museum's Anthony Austen as reference.

Soon after arriving at the museum during March 2020 from Duxford, the bomber was painted in the markings of a Heinkel He 111 H-2, in the livery of A1+DA from Stab/Kampfgeschwader 53 which was shot down on 15 September 1940 — now commemorated as Battle of Britain Day — over East London during an attack on the Beckton gasworks.

Some wreckage from A1+DA lay undisturbed until 1986 when the area was being developed to form part of the new Thamesmead Estate. Items including a large section of the ventral gunner's gondola, an undercarriage leg and tyre and two MG 15 machine guns are also on show in the museum.


CASA 2.111B B.2I-103 being worked on at Hawkinge on 16 September. KBBM

Fagen Fighters puts combat vet P-39 on show



One of the most original and historic Second World War fighters to have been put on museum display for many years, P-39 Airacobra 41-6951 at the Fagen Fighters WWII Museum in Granite Falls on 10 September. FAGEN FIGHTERS

Bell P-39 Airacobra 41-6951 went on show at the Fagen Fighters WWII Museum in Granite Falls, Minnesota on 10 September, 83 years after it made a forced landing near Weipa, Queensland, Australia. The fighter was recovered during September 1972 by Sid Beck and displayed at Beck's Military Collection at Mareeba, Queensland until the museum closed down during 2016. It was recently acquired by Fagen Fighters and arrived at Granite Falls in May of this year.

The machine was originally assigned to the US Army Air Forces' 36th Pursuit Squadron, 8th Pursuit Group, part of the 5th Air Force. It arrived at Brisbane at the start of March 1942. Assigned to 2nd Lt Charlie Falletta, flight commander of D Flight, it soon gained the name *Ermine* on the nose in honour of Falletta's wife. The 36th was rapidly ordered to replace the Royal Australian Air Force's No 75 Squadron, which had been fighting an attritional battle against numerically superior Japanese forces.

Falletta was one of six pilots chosen to join No 75 Squadron in the air defence of New Guinea. A flight of six P-39s left Lowood airfield near Brisbane on 5 April heading for Port Moresby, with four intermediate fuel stops. Falletta was the first to arrive at Moresby, 41-6951 thus becoming the first known American fighter aircraft to land in New Guinea during the Second World War.

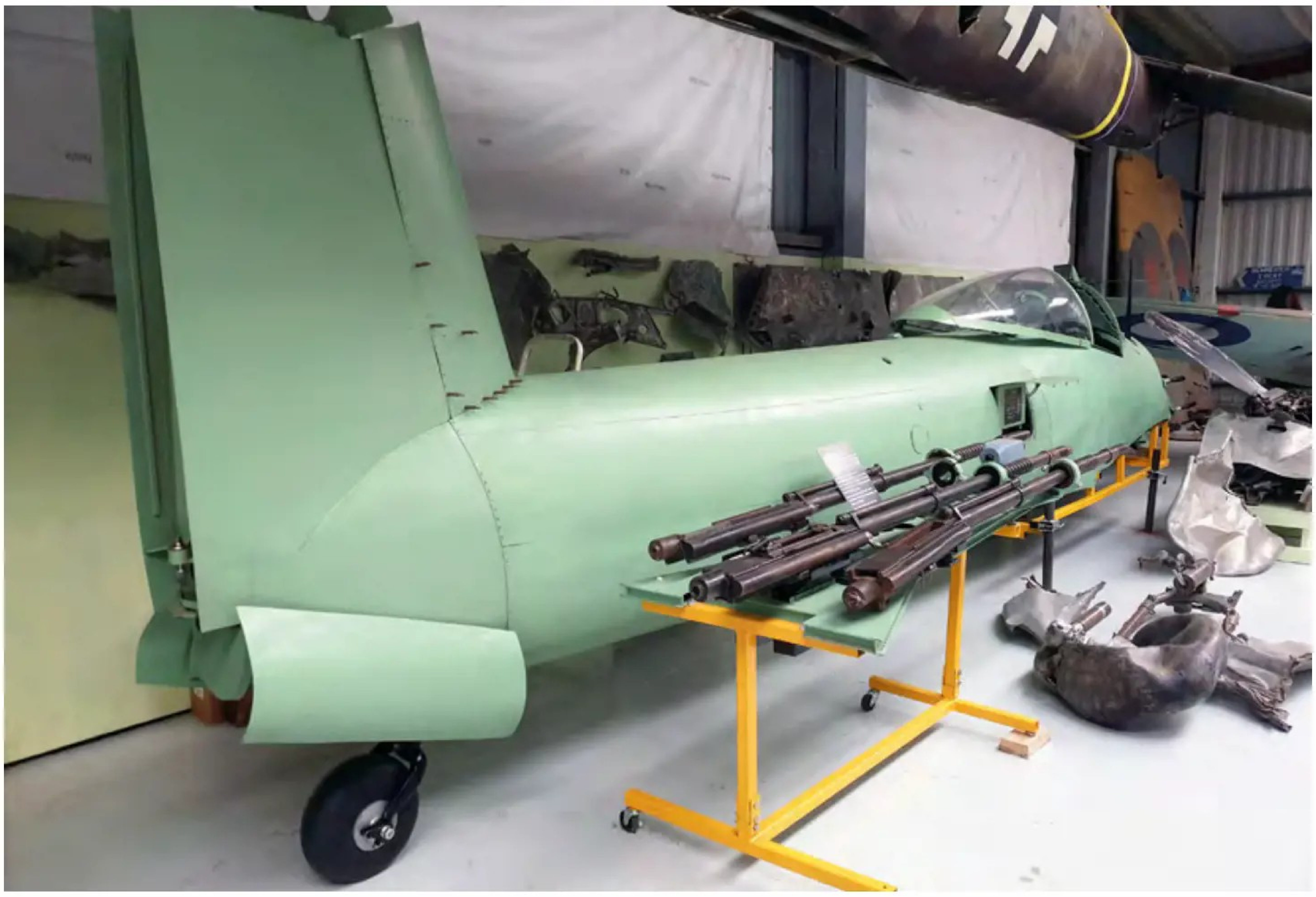
During the following five days, 41-6951 flew an impressive total of 17 combat missions, the sorties being led by African campaign Australian veteran Sqn Ldrs John Francis Jackson and Peter Turnbull, and the aircraft being responsible for the destruction of two Mitsubishi G4M 'Bettys' and a Zero.

The flight returned to Australia on 11 April to rejoin the 8th Pursuit Group at Antil Plain near Townsville, where Falletta and the five other pilots started training rookie pilots on combat flying techniques. Those duties completed, on 1 May the six P-39s, commanded by Falletta, departed Antil Plain heading back to Moresby, and after their final fuel stop at the important staging point of Cooktown on Queensland's Cape York Peninsula set course for Horn Island. Suffering from a lack of accurate meteorological information and experiencing very poor weather while en route, after several unsuccessful attempts to land in tropical storm conditions the flight, getting low on fuel, headed south in a desperate search for somewhere to land. Falletta identified what looked like a suitable field just inland, which turned out to be home to flocks of turkeys, the male of the species having constructed mounds of leaf litter to incubate eggs. Just as 41-6951 was slowing to a halt, the right-hand wheel struck a small ditch, the right undercarriage folding. Falletta's wingman, Lt Harvey, made a successful wheels-up landing nearby, and the four other Airacobras completed emergency landings on the beach near Cape Orford Ness. Lt Robert R. Love attempted to land with the undercarriage down and was killed when his P-39 cartwheeled, but all the rest of the pilots went on to survive the war.

Whirlwind fighter gets a tail

During the weekend of 20-21 September the Westland Whirlwind Fighter Project's chief engineer, Lancashire-based Peter Smith, transported south and supervised the fitting of the newly completed tail section for the project's Whirlwind replica at the Kent Battle of Britain Museum at Hawkinge.

The rear fuselage, tail strut, tailwheel bay and retractable tailwheel are now in place, so, for the first time since Whirlwind P7048/G-AGOI was scrapped during 1947, the full side profile of Westland's formidable cannon-armed fighter can be seen in the flesh.



RIGHT: Something we never thought we'd ever see: a Westland Whirlwind fuselage, now complete with tail, at Hawkinge on 21 September. DAVE BROCKLEHURST

Manston receives donation for PR 'Spit'

On 17 September the Spitfire and Hurricane Memorial Museum at Manston announced a £6,000 donation towards construction of a replica Spitfire PRXI fuselage section from the Hooper Family Trust. It will become a permanent feature at the museum, following the success of the recent temporary exhibition there of the fuselage of Spitfire PRIV AA810, which is under restoration to fly.

"We're incredibly grateful to the Hooper family for their generous funding, allowing us to commence this ambitious project", said Chris Burton, chair of trustees at the Spitfire and Hurricane Memorial Museum. "This donation brings us one step closer to making our latest exhibition project a reality and opens up exciting possibilities for educational outreach, especially in inspiring young minds in STEM (science, technology, engineering and mathematics)."

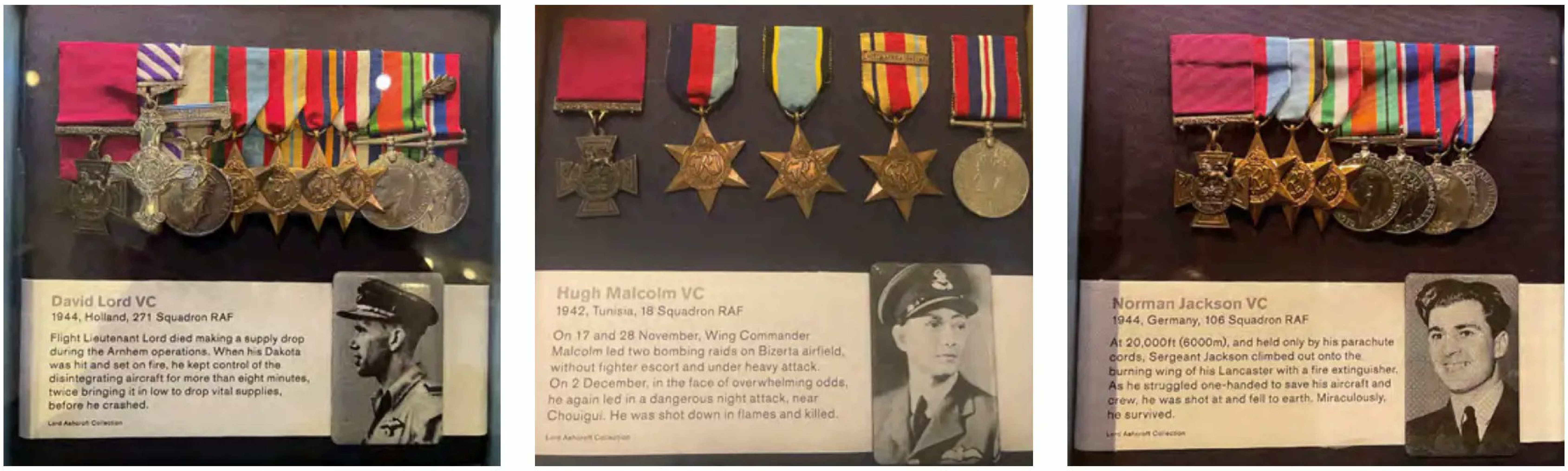
The owner of AA810, Tony Hoskins, adds, "We are absolutely delighted to be working with the Spitfire and Hurricane Museum to recognise in particular those from the area who contributed to the wider RAF reconnaissance community."

The part-constructed fuselage of Spitfire PRIV AA810 on display in the Spitfire and Hurricane Memorial Museum at Manston in late August. SHMM

Plans emerge for Duxford tech development

On 19 September it was announced that HBD has been chosen as development partner for a £162-million aviation technology campus at IWM Duxford. The project will see 25 acres of IWM land becoming Duxford AvTech, a joint initiative with Gonville and Caius College. A planning application is due before the end of 2025. It is said the development will generate 1,200 jobs. However, at first glance, the complex would appear to represent an intrusive development on an important heritage site.

IWM consigns unique VC collection to storage



David Lord VC
1944, Holland, 271 Squadron RAF
Flight Lieutenant Lord died making a supply drop during the Arnhem operations. When his Dakota was hit and set on fire, he kept control of the disintegrating aircraft for more than eight minutes, twice bringing it in low to drop vital supplies, before he crashed.
Lord Ashcroft Collection

Hugh Malcolm VC
1942, Tunisia, 18 Squadron RAF
On 17 and 28 November, Wing Commander Malcolm led two bombing raids on Bizerta airfield, without fighter escort and under heavy attack. On 2 December, in the face of overwhelming odds, he again led in a dangerous night attack, near Chouigui. He was shot down in flames and killed.
Lord Ashcroft Collection

Norman Jackson VC
1944, Germany, 106 Squadron RAF
At 20,000ft (6000m), and held only by his parachute cords, Sergeant Jackson climbed out onto the burning wing of his Lancaster with a fire extinguisher. As he struggled one-handed to save his aircraft and crew, he was shot at and fell to earth. Miraculously, he survived.
Lord Ashcroft Collection

Arnhem VC David Lord's medal group, Blenheim pilot Hugh Malcolm's medals, with his VC on the left, and Lancaster flight engineer Norman Jackson's awards, gained during a 31-ops tour, while still on display in the Lord Ashcroft Gallery at IWM London during August. TONY HARMSWORTH

The Lord Ashcroft Gallery at IWM London in Lambeth was permanently closed on 30 September, with the world's largest collection of Victoria Crosses now being off public view and in storage.

The gallery opened in 2010 to house Lord Ashcroft's collection, the billionaire businessman also funding the exhibition space with a £5-million donation. The initial agreement was for the collection to remain on loan to the Imperial War Museums for 15 years, although Ashcroft had intended to renew the loan and almost certainly eventually bequeath it to the museum. Ashcroft has stated that other institutions, including some from overseas, have offered to house the collection. The IWM says it has closed the gallery to free up space to focus on post-World War Two conflicts.

One of the museum's other buildings, the AirSpace hangar at Duxford, is also now undergoing transformation into a Cold War exhibition, which has resulted in the permanent eviction of some rare Duxford Aviation Society-owned aircraft — including Avro York G-ANTK and DH Comet 4 G-APDB — from a building that opened as recently as 2007 with much of the funding coming from the lottery and public donations.

Many of the medals in the exhibition were awarded to RAF personnel: Flt Lt David Lord's posthumous VC, conferred for pressing home a supply drop to Arnhem after his Dakota had been mortally damaged, was on show, as were 25-year-old Blenheim pilot Wg Cdr Hugh Malcolm's medals, the Scotsman having been killed while leading a bombing raid on Bizerte airfield, Tunisia, without fighter escort on 4 December 1942. Malcolm had previously been air liaison officer on Lt Gen Bernard Montgomery's general staff, and post-war welfare clubs for RAF personnel, which operated in several countries, were named Malcolm Clubs in his honour.

Lancaster flight engineer Sgt Norman Jackson had already completed a 30-sortie tour, but as one of those was with another crew he elected to fly a 'second 30th mission' on 26-27 April 1944 so as to be with his regular crew. Over Schweinfurt he climbed out onto the wing of his burning Lancaster, gripping the air intake on the leading edge with one hand while trying to put out the fire with an extinguisher in the other. A further burst of fire from a night fighter blew Jackson from the wing, his smouldering parachute just about saving his life as he hit the ground hard after a 20,000ft fall, suffering a broken ankle and several other injuries. Jackson died at the age of 74 in March 1994. Ashcroft acquired Jackson's VC at auction during April 2004 for £235,250.

On Ashcroft's website, a passage from an interview he gave to *The Times*, published on 22 July says he "...learnt, from a third party rather than the IWM itself, that the gallery bearing my name is to close because the museum wants 'to share more stories of conflicts that are within many of our visitors' living memory'...

"I built my VC and GC [George Cross] collection over a period of four decades and it is estimated to be worth £70 million until the IWM decided this medal collection was no longer wanted. I had intended to leave it to the museum in my will. Unsurprisingly, that is no longer going to happen: it is galling enough that the gallery I paid for will now be used for purposes over which I have no control.

"This sorry episode has, however, had some silver linings. I have been overwhelmed by the messages of support from so many people who think this decision by the IWM is plain wrong. I am also grateful that other museums are trying to find ways to display my VC and GC medal groups in future so that this unique collection does not simply gather dust in a vault."

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de Havilland museum wins top NTT award

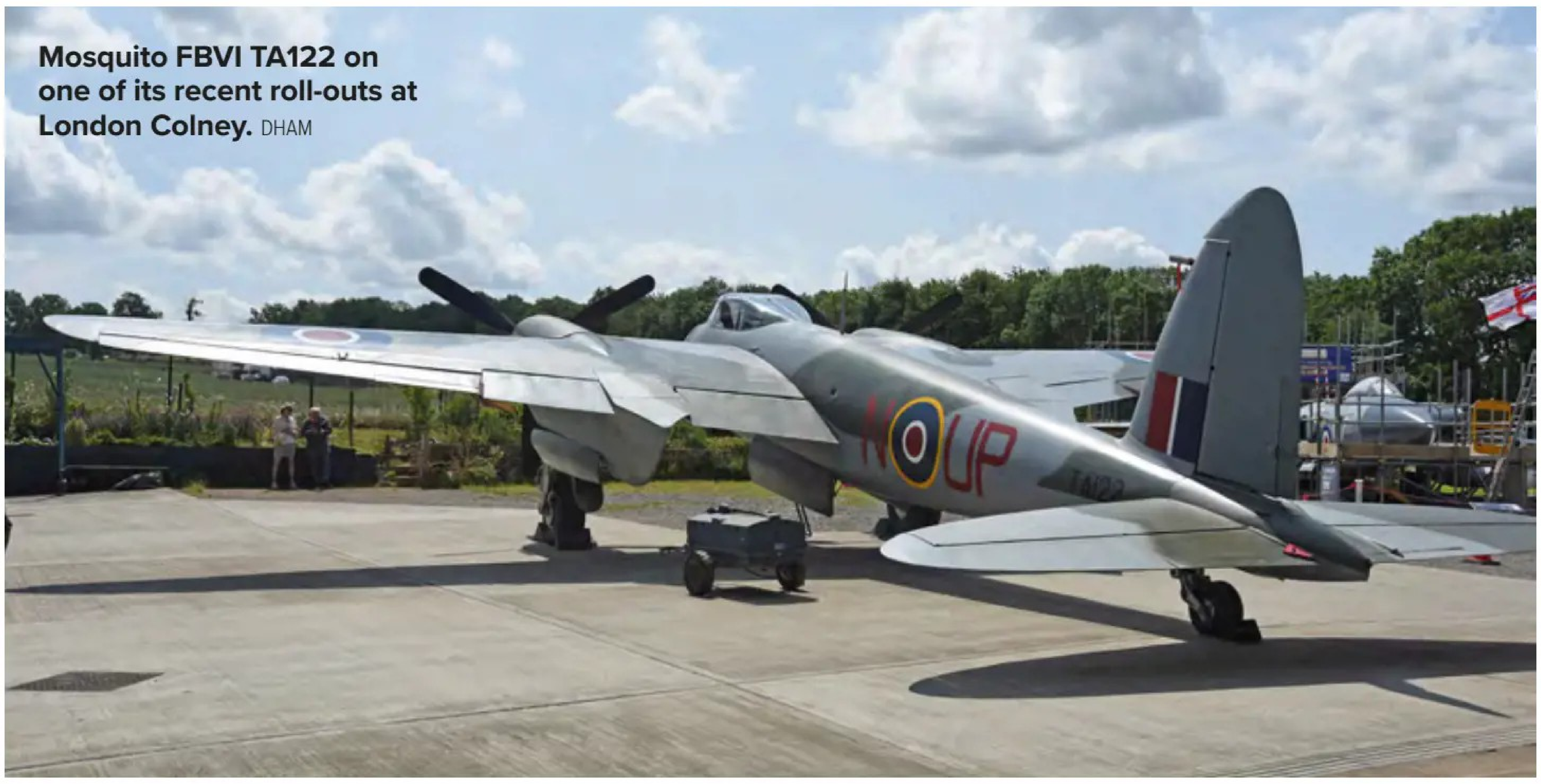
On 9 September the National Transport Trust's prestigious Preservationist of the Year silver trophy was presented to a team from the de Havilland Aircraft Museum in a ceremony held at Fawley Hill, Henley-on-Thames, the home of the trust's president Judy, Lady McAlpine. The award is in recognition of the high standard of restoration work and authenticity lavished on Mosquito FBVI TA122. The project has taken nearly 50 years to complete, and work continues on the further conservation of the aircraft.

Originally delivered to No 605 Squadron at Ford, Sussex during early March 1945, TA122 has a combat history: on 2 May it was flown from Volkel in the north-east of the Netherlands by the unit's commanding officer, Wg Cdr Angus Horne, on a night intruder mission to Esens in northern Germany. Withdrawn from RAF service during 1950, the fuselage saw use at Delft University as a teaching aid from 1951 until 1970. It was donated to what was then the Mosquito Museum at Salisbury Hall in 1977.

Commenting on the award, National Transport Trust chairman Stuart Wilkinson said, "TA122 was sold out of service in 1950 for £15. To make it fit in its new home, the wing was sawn off either side of the fuselage. The early years of the restoration were spent gathering components, and work halted as other projects took priority. A wing was sourced from Israel, and other components came from Canada, Australia and New Zealand. Work on the wing began in 1985; it took 15 years. The wing and fuselage were reunited in 2009; engine and propellers were fitted in 2014. TA122 now wears her 1945 No 605 Squadron colours and stands as a testament to the efforts of the de Havilland Museum team, 'Preservationists of the Year' for 2025."

The National Transport Trust was founded in 1965 as the Transport Trust and is the UK's only national charity established to promote and encourage the preservation and restoration of Britain's unique transport heritage in all its forms: by air, land (road and rail) and water (sea and inland).

Eight of the de Havilland Aircraft Museum's Mosquito TA122 restoration team at Fawley Hill, with National Transport Trust president Judy, Lady McAlpine, on the right. Ian Thirsk, Mosquito authority and the author of our 'First Among Equals' feature on pages 26-38, is in the centre, holding the citation. DHAM



Mosquito FBVI TA122 on one of its recent roll-outs at London Colney. DHAM

Weather hits Freddie March concours

Comedian/musician Bill Bailey is shown the cockpit of Spitfire Ia X4650 by Dr Jo Salter MBE, the RAF's first female fast jet pilot, who flew the Tornado with No 617 Squadron — and is featured on pages 62-69. STEPHEN BROOKS

The Goodwood Revival's Freddie March Spirit of Aviation concours d'elegance for pre-1966 aircraft suffered a near-washout over the weekend of 12-14 September, meaning no judging took place for the first time since the contest was inaugurated. Among the small number of aircraft that made it was Lincolnshire-based former racing driver Mark Hales's Miles Messenger IIa 'RG333'/G-AIEK, which arrived on the 11th but left the next day due to the unfavourable forecast for Saturday and Sunday.

The traditional 'dawn patrol' prior to the start of track action was flown on 14 September by two of the immortal, original, Duxford-based 'old stager' Spifire LFIXs, in the shape of the Old Flying Machine Company's MH434 and Comanche Fighters' ML417. They were accompanied by Hurricane I P2902 from Fighter Aviation Engineering.

Another Comanche Fighters Spitfire, MkIa X4650/G-CGUK, was seen being inspected by comedian Bill Bailey during the Sunday morning, just hours after his show-stopping performance on a typewriter at the Royal Albert Hall, accompanied by the BBC Symphony Orchestra during the Last Night of the Proms.

The volatile weather conditions experienced at Goodwood are evident in this shot of Hurricane I P2902 on the evening of 13 September. TONY HARMSWORTH

NEWS IN BRIEF

JOHN LUCKADOO 1922-2025

John 'Lucky' Luckadoo, thought to have been the last surviving pilot from the 8th Air Force's 100th Bomb Group, the 'Bloody Hundredth', died on 1 September in Dallas, Texas at the age of 103. Luckadoo flew 25 missions in B-17s over Germany during 1943-44, and was a lead consultant on the recent TV series *Masters of the Air*. 'Lucky' was also an honoured guest at the rededication of the American Air Museum at IWM Duxford during September 2002.

WESTON GETS A SEA KING

Westland Sea King HU6 ZA133 was delivered to The Helicopter Museum at Weston-super-Mare by road from HMS *Sultan* at Gosport on 15 August. The machine was operated from HMS *Hermes* and RFA *Fort Austin* during the 1982 Falklands conflict.

UNLIMITEDS PULL OUT OF ROSWELL RACES

Following the National Championship Air Races' move from Reno, Nevada to Roswell, New Mexico, the Unlimited class pulled out of the inaugural event at the new location on 10-14 September. The popular T-6 races did go ahead, the winner of the Gold medal being Chris LeFave of Caldwell, Idaho, in AT-6C *Midnight Miss III*.

K. G. ECCLES

STEVE SLATER

HangarTalk

A vintage light aircraft aficionado's view on historic aviation

I'm hazarding a guess here, but I'm assuming that if you're reading this you're more than likely to be on the uphill side of 40 — at the very least. That is the demographic of classic aeroplane enthusiasts. The classic car, vintage boat and heritage railway communities all face similar challenges. So, how do we make historic aviation accessible and attractive to younger people?

Some people are working on solutions. André Faehndrich organises an annual Young Aviators' Day at the former USAAF B-17 base at Deenethorpe in Northamptonshire. He invites young people of all ages from scout troops, air scouts and non-scouting bodies.

Sponsored for the second year by AOPA UK, a large marquee was the centre for many activities including sketching under the supervision of the Guild of Aviation Artists, navigation challenges set by the Royal Institute of Navigation, radio-control model aircraft and an 'Egg Crash Challenge' — in which a model 'flying device' had to be built with an egg on board, and then flown without the egg cracking — as well as flights in a range of light aircraft, heritage types and microlights provided by local aviators. Outside there were some entertaining radio-telephony activities, paper planes and much more. Said André, "I firmly believe in getting youngsters involved and inspired early, so that this gives them a good grounding towards them being inspired and then getting involved as the aviators, engineers and astronauts of the future."

SHUTTLEWORTH
B MA
5

Pedal planes galore at Old Warden, with one of their full-sized brethren.
VIA STEVE SLATER

> *There is a thriving pedal plane community*

Of course, organisations like the Guild of Air Pilots, the Worshipful Company of Coachmakers in London — which offers Tiger Moth scholarships — the Light Aircraft Association and the British Women Pilots' Association all provide help to aid young aviators in gaining their licences. Some restorers run apprenticeship schemes to give working experience on historic aircraft, although such places are eagerly fought-for.

At one of Britain's most popular airshow venues, more junior visitors to the Shuttleworth Collection can also enjoy a wide range of entertainment. Co-ordinated by the collection's education officer Matthew Studdert-Kennedy and his team, Shuttleworth's hangars at each display include wind-tunnels, flight simulators, an opportunity to build or paint Airfix kits and a chance to colour pictures or draw the aircraft on show.

And a real highlight at Shuttleworth events is provided by the Joystick Club's pedal planes. Plywood caricatures of the real aircraft, they feature pedals attached to the undercarriage, allowing young would-be aviators to 'fly' them around a control tower in a fenced-off area inside one of the hangars. They were part of the outside entertainment at Duxford's September show too.

Originally the brainchild of some retired pilots at White Waltham, the pedal plane 'circus' now includes replicas of larger multi-engined aircraft such as a Dakota, Catalina and even a C-17 Globemaster III. There is a thriving pedal plane community, with kits or plans of the most popular designs available on both sides of the Atlantic and a giant 'rally' held at Old Warden each Christmas.

So, perhaps one day someone whose interest was first sparked by pedalling one of these splendid little devices around at Old Warden might end up flying for the collection. It's a really nice thought — and it could just happen.

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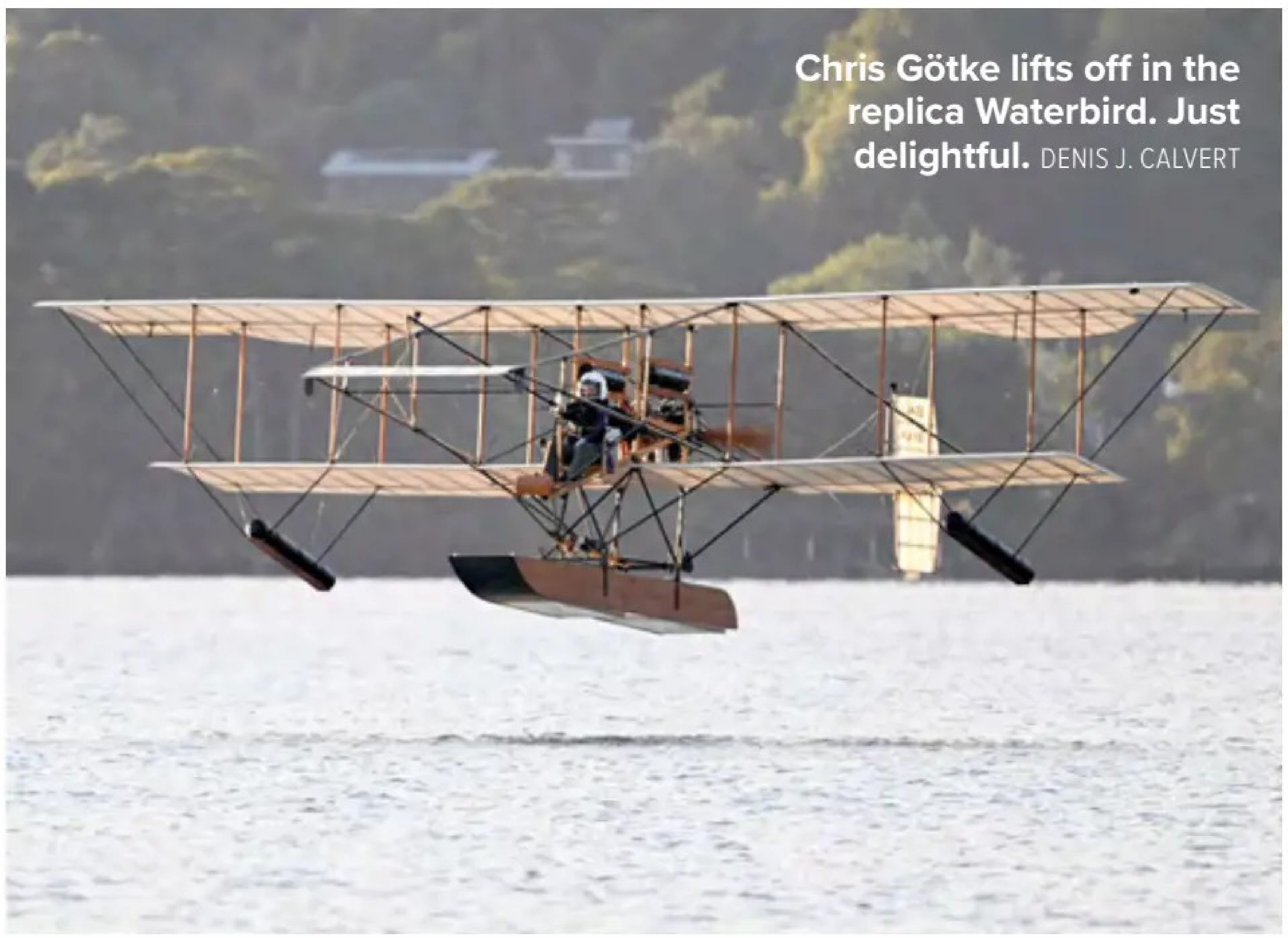
DENIS J. CALVERT

FlightLine

Recollections and reflections — a seasoned reporter's take on aviation history

I guess you might view this month's column as a report written while I'm on holiday which, in a sense, it is. For the past four years, I've made an annual pilgrimage to the Lake District where, for one weekend a year, the replica Waterbird has given a public display of flying on Lake Windermere. The original Waterbird of 1911 was the first British hydro-aeroplane to fly successfully, which it did on 25 November 1911 from the same location. Thus, bringing the replica — which spends most of its year stored, wings off, in a hangar at Liverpool Airport — back to Windermere represents something of a homecoming, a reunion of machine and location.



Chris Götke lifts off in the replica Waterbird. Just delightful. DENIS J. CALVERT

This year's public demonstrations, promoted as Wings over Windermere, took place on 5-6 September. Such events take a lot of planning and only happen as a result of permissions granted by the CAA and the Lake District National Park Authority. Flying display director Charles Sunter explained some of the complexities. The flying activity can only take place once the pleasure steamers have tied up for the night, hence a display window of 18.45 to 19.30. The display area must be 150m away from the nearest person or crowd. A fleet of 11 marshal boats patrols the lake to keep the display area sterile, although the byelaws do not allow them to forbid other boats entry, only to request compliance. Fortunately, in most cases, the legendary British amenability ensures this without confrontation. Nevertheless, small boats often line up to the west, their occupants enjoying a beer in the shadow of Langdale Pikes while watching Waterbird fly. Good to report, this year's displays went off without a hitch. As ever, the sight was truly mesmerising, the aircraft building up speed, rising into the air at about 35kt, then flying for a few hundred metres before settling back onto the water with a cloud of spray from the stepped float.

> *"I got faster and faster and faster until we lifted off the water"*

Pilot for 2024 and 2025 has been Lt Cdr Chris Götke, following on from Pete Kynsey who flew Waterbird for its first two seasons. Chris's day job is as the Empire Test Pilots' School fixed-wing commander at Boscombe Down and he has flown a multitude of types. But did anything, I asked him, prepare him for flying Waterbird? "Obviously, I flew a Swordfish from the 1936 era [as CO of the Royal Navy Historic Flight]. But the answer is, without a doubt, 'no'. I spent a fair amount of time talking to Pete Kynsey about how he flew it, as well as 'Dodge' Bailey down at Shuttleworth who flew the Boxkite. And then when I went into it [Waterbird] the first time on a day of perfect conditions, it was a case of 'let's just see what happens'. We'll build the speed up and see where it goes. And over half an hour, I got faster and faster and faster until finally we lifted off the water". If this makes it sound easy, it surely was not.

I asked Ian Gee, very much the man behind Waterbird and the Lakes Flying Company, whether there was the possibility, with suitable funding and all the requisite permissions, for it to display at another freshwater site in the UK. His reply was encouraging: "The original Waterbird had to be made in sections since it was built in the cellar at Brownsfield Mill in Manchester, then transported by rail to what is now Piccadilly railway station, on to Brooklands and then up to Windermere. So, in the same way that we transport Waterbird to Windermere [by road], we could certainly transport it elsewhere". I leave readers to dream of their favoured location.

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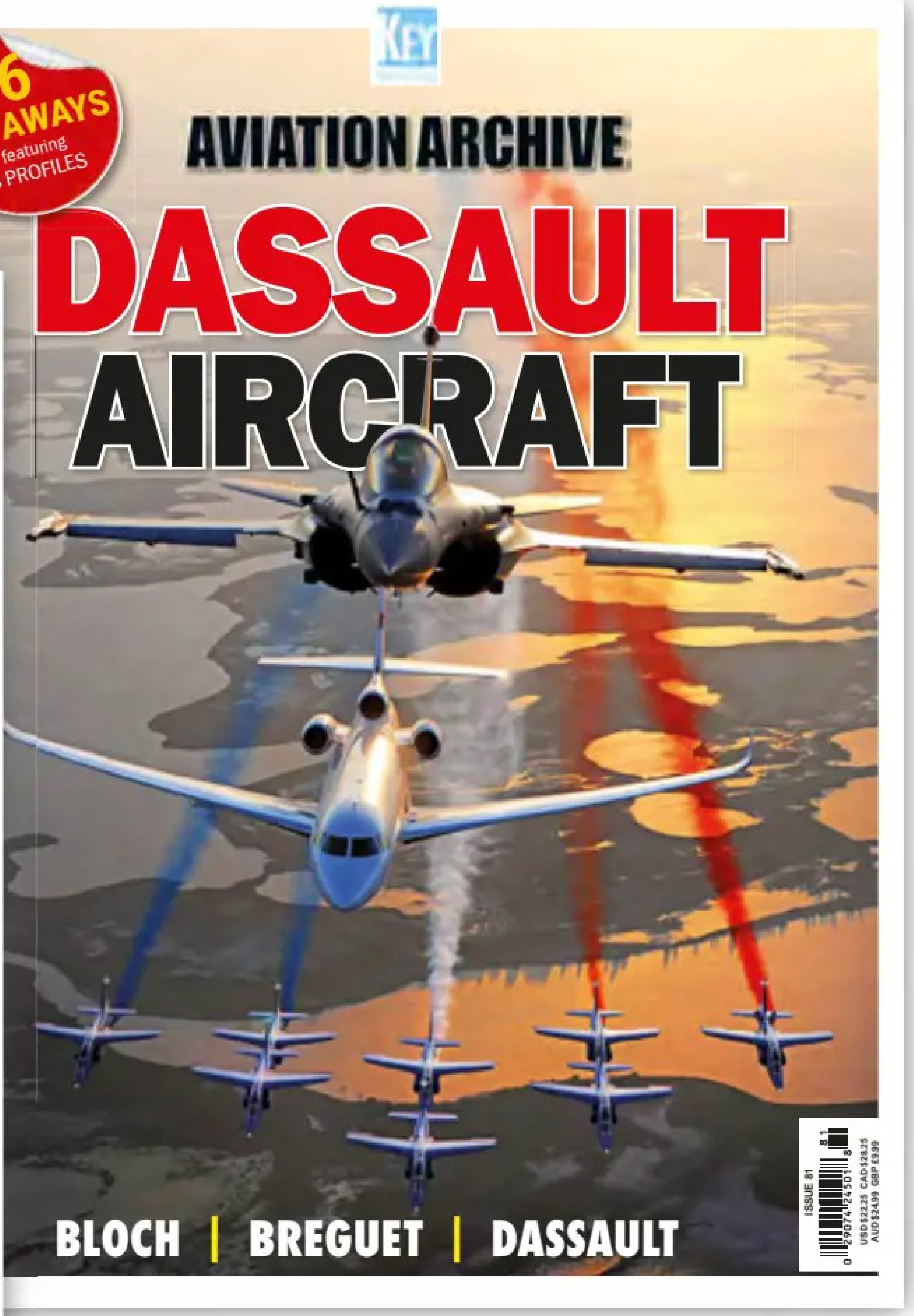
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893/25

RICHARD CROCKETT

From the Cockpit

Join one of Shuttleworth's newest pilots on his vintage flying journey

In September 2024, I had the privilege of flying at the Duxford Battle of Britain Air Show — a highlight I shared in my column this time last year. It was an unforgettable experience, and to my delight I was invited back for the 2025 show, to once again fly David Bramwell's Miles Magister but this time alongside two Tiger Moths and a Chipmunk.

As always, a Duxford weekend begins on Friday, the designated practice day. I arrived at Old Warden bright and early with my crew for the weekend, Julian Harcourt, only to be met by a rather glum Shuttleworth engineer. During the previous day's 20-hour inspection, some damage had been discovered that needed urgent rectification before the Magister could fly. Thankfully, the Shuttleworth engineers are nothing short of miracle-workers. They had already begun repairs and, true to their word, had the aircraft ready by 16.00hrs, allowing me to make the short hop to Duxford.

Duxford turned out to be a brief outing for the Chipmunk and Magister pair, flown by Phil Hardisty and Richard. MATTHEW LING

On arrival, I joined my fellow formation pilots for the weekend, Phil Hardisty, Alex Lewton and Tom Turner. Tom, who also happens to be Duxford's head of airfield, secured us a late rehearsal slot. After a thorough briefing and a walk-through of the display, we headed out to our aircraft. Soon, we were airborne as a four-ship, making several passes before breaking for individual displays: a Magister solo, followed by a Chipmunk aerobatic routine. With practice complete, we debriefed, tucked the aircraft away and headed to a nearby pub for a well-earned meal and more discussion, very much looking forward to the show weekend ahead.

> **"For those of us in light trainers, the wind meant the war was over"**

Saturday morning brought less-than-ideal conditions. Overnight, the wind had strengthened and swung southerly, blowing 90° across the runway and straight towards the crowd, the worst possible scenario at Duxford. Despite this, we briefed and walked through the display. Unfortunately, the wind proved too strong for the Tiger Moths, reducing our formation from four to two.

Phil and I strapped in and taxied to runway 06, ready for our slot. However, the preceding act had used ground-based pyrotechnics, and debris on the runway delayed our take-off. By the time we were cleared, five of our eight minutes had already elapsed. We launched regardless, but with only two minutes remaining, the flying display director understandably couldn't allow us to over-run, especially with major acts like the famous Duxford 'Big Wing' still to come. Two minutes later we were back on the ground, disappointed our slot was so short, but still pleased to have flown at such an illustrious airfield.

Sunday brought even stronger winds. Conditions were so severe that even some of the heavy warbirds elected to stay grounded. For those of us in light trainers, the decision was clear: the war was over. It was disappointing, of course, but any attempt to fly would have been reckless. Thankfully, by the end of the display things had eased enough for us to return the Magister to Shuttleworth where an into-wind runway made for a safe landing.

Despite the challenging conditions and limited flying, displaying at Duxford is always an honour and it was wonderful to once again share the experience with good friends. This year's show was particularly special because flying Hurricanes in the 'Big Wing' were Mike Collett and Andy Monk, two great friends from our days as instructors at Booker Gliding Club. It's quite amazing to think how things have changed for us over the years!

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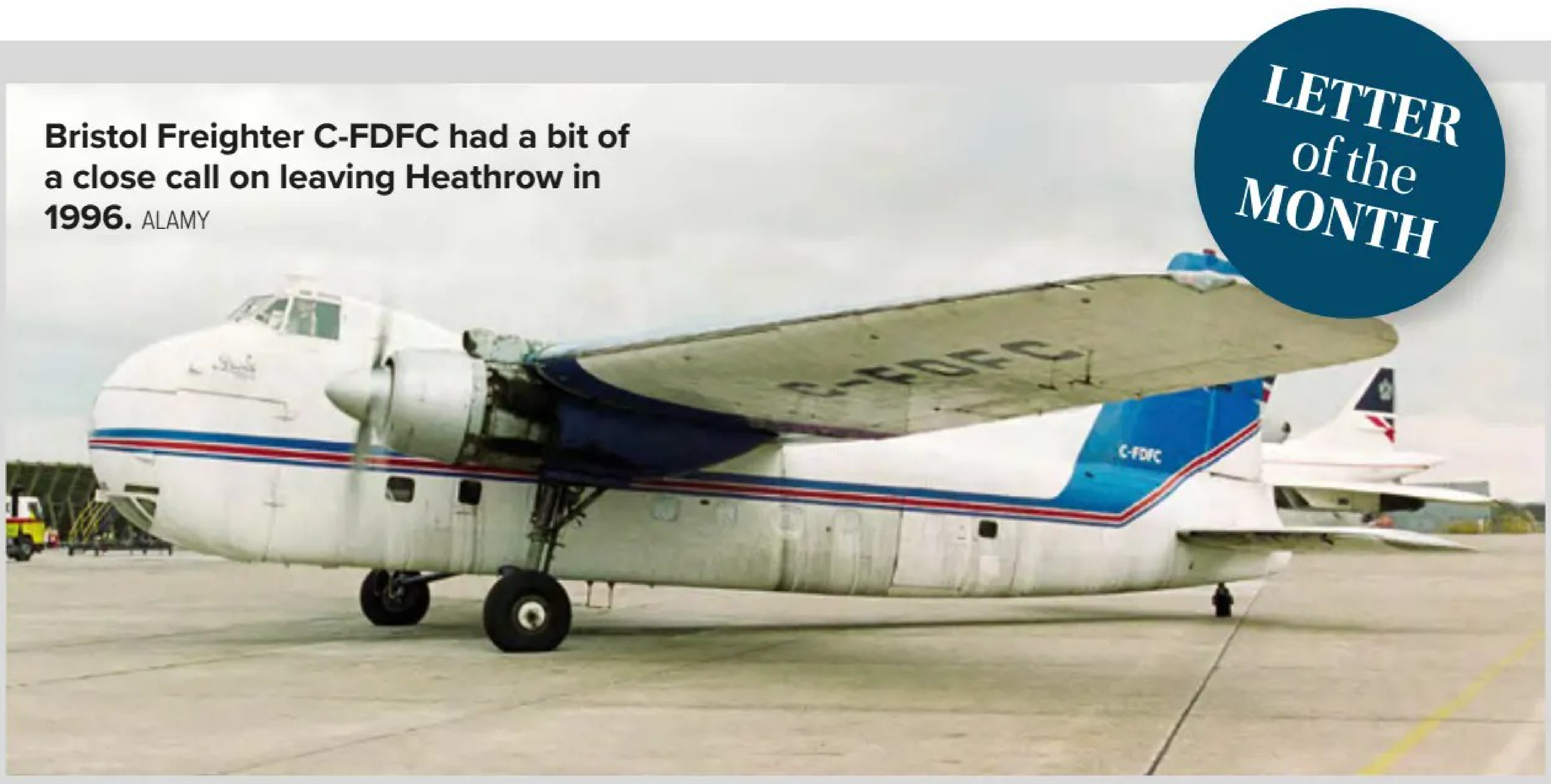
LETTER of the MONTH


Bristol Freighter C-FDFC had a bit of a close call on leaving Heathrow in 1996. ALAMY

The recent article on David Roome and his flypasts (*Aeroplane* September 2025) brought back a number of interesting, and a couple of potentially scary, memories.

In 1996 I was working for the CAA as flight standards officer with the primary responsibility for the monitoring of UK air displays. During mid-1995 Heathrow started the planning of the 1996 50th anniversary flypast event and I was deputed to attend on behalf of the CAA. It became quickly very clear to me that while the Heathrow team were all highly experienced — and hugely enthusiastic — controllers, they had little experience or knowledge in putting together this kind of event. I strongly recommended they engage an experienced outside agency to assist with the detailed planning. Having been personally involved with the International Air Tattoo over many years, and knowing David Roome was part of their team, I suggested they contacted Tim Prince and Paul Bowen to see if they were happy to assist, which they did.

The detailed planning went ahead over the next 12 months with all the airspace restrictions, flypast routing and much else being very well put together, as I knew they would be, by the IAT and David Roome team. However, there was very nearly a real 'fly in the ointment' moment about 10 days before the actual event when, at just about the final planning meeting, a London Air Traffic Control Centre controller — who will remain nameless — stood up and announced loudly, "This is an illegal event. You cannot do this in Class A airspace and I am going to get it stopped as of now."

It took some time for this to sink in. However, it struck me the LATCC guy was wrong. This was no longer Class A airspace; it was restricted airspace (temporary) and under the direct control of Heathrow, and they could do what they wanted inside it. A quick conflab with Tim Prince followed and he agreed with my assessment. I later confirmed this with the CAA ATC guys and a senior manager at LATCC who confirmed the flypast had their full support. Phew!

On the day itself, Heathrow laid on a Bell JetRanger to fly myself, David Roome and a couple of others from Heathrow to Stansted for the briefing, which David conducted, and return us to Heathrow afterwards. While hovering at a few hundred feet to the south of Heathrow, waiting to cross en route to Stansted, we watched the departure towards the west of the Bristol Freighter from Heathrow's southerly runway. His departure clearance was, "Runway heading to 1,500ft and then right turn on a direct track to Stansted". Now, most airliners would be miles west of the airfield before they got to 1,500ft, but not the Freighter as it was very lightly loaded. He got to 1,500ft about half-way down the runway and, as per his clearance, turned right on a direct track to Stansted, taking him right across the middle of the northern runway just as a Virgin 747 did a missed approach over it. None of us were on common frequencies to give a warning! They got fairly adjacent, but did see each other in time for a safe avoidance. If the visibility had been poor it would have been a close call.

On returning to Heathrow, David and I went down to Thames Radar, at the base of the Heathrow tower, to watch the early proceedings on radar. The train got airborne from Stansted and proceeded, for the most part, via Duxford — Singapore Airlines 747 excepted — on to Clacton and into the 'rolling' restricted airspace en route to Heathrow. All appeared to be going well. Three aircraft did not follow this routing, the Lancaster and the two Dragon Rapides. The Rapides were firstly much slower than any other types (even the Freighter) and, secondly, they did not have transponders. They routed south from Stansted towards the London City Airport vicinity and then onto the Heathrow centreline well ahead of the faster types following behind.

The Lancaster, which was transponder-equipped, was to follow a similar routing to the Rapides with timing set to pass under them at about two to two-and-a-half miles out from Heathrow. However, the 'Lanc' appeared to be sculling around north of Duxford for no apparent reason — all clearly seen on radar — until, somewhat late in our opinion, he set off south. Somewhere around the M11/M25 junction the 'Lanc' took a track direct for Heathrow, basically across the middle of London.

At this, we went to the tower and could clearly see up the centreline the two Rapides and, far off in the distance, the train of bigger and faster aircraft. But no sign of the 'Lanc'. As the Rapides approached the eastern end of Heathrow the 'Lanc' appeared north of them at low level, clearly going like the clappers. The Rapides were, if memory serves, at 700ft, and as they crossed the eastern boundary the 'Lanc' shot underneath and opened the proceedings — on time, but only just.

It was also interesting to note that the last aircraft to land at Heathrow prior to the start of the flypast was an Alitalia DC-9 about three or four minutes before things began. From about half-way through the flypast, over the northern runway, aircraft from the flypast were landing on the southern runway. A very slick operation superbly managed by the Heathrow staff, ably assisted by IAT and David Roome. It was a great privilege to watch it all 'from the inside', as it were.

Rod Dean

The article on the Tiger Force (*Aeroplane* August 2025) reminded me of some research I did a few years ago, which turned up an approach from before the operations described.

At the Allied conference in Quebec in September 1944, Churchill had undertaken to transfer a large part of Bomber Command, comprising 500 to 1,000 bombers, to the Pacific once the war in Europe was finished. As a result the RAF began looking at the feasibility of establishing such a strategic bomber force in the Pacific.

An initial study suggested bombers could be moved across a trans-Siberian route from Europe, based in the Soviet maritime provinces near Vladivostok, and then used against Japan. The plan was to move 20 Lancaster bomber squadrons and 20 Lancaster air-to-air refuelling tanker squadrons to Cairo, fly them to Tehran and link up with the route to Krasnoyarsk. This was the route used by the Soviet ferry pilots when delivering aircraft they had picked up from Alaska. The file in the National Archives on this includes, as background, a description of a flight undertaken in May 1944 by an assistant military attaché from the Canadian embassy in Moscow from Moscow to Krasnoyarsk, from Krasnoyarsk to Fairbanks, Alaska, and then to Edmonton and Ottawa.

This idea of basing a bomber force in Soviet territory was soon dropped because of the political complexities. Not surprising!

Ray Flude

I was thrilled to see the picture on page 27 of the June issue of *Aeroplane* showing the Armstrong Whitworth Argosy and DHC Twin Otter at Salalah, parked up in the dispersal. I was the captain of that very Argosy at Salalah, and I guess I may be one of the crew depicted in the photo. I spent many happy days flying the Argosy based at Khormaksar, Aden and later in Bahrain, Benson and Akrotiri, Cyprus between 1965 and 1975. Stationed at Khormaksar, we regularly flew the route along the Gulf of Arabia and the Arabian Sea between Riyan (Mukalla), Salalah and Masirah.

When the Twin Otter departed he didn't need the luxury of what I seem to remember was a 6,000ft-long oiled sand runway. He simply applied full power, lifted off in what appeared to be a very few feet and he was gone. It certainly impressed me, but obviously not the Sultan, hence the lack of an order!

Flt Lt David Pritchard, RAF (ret)

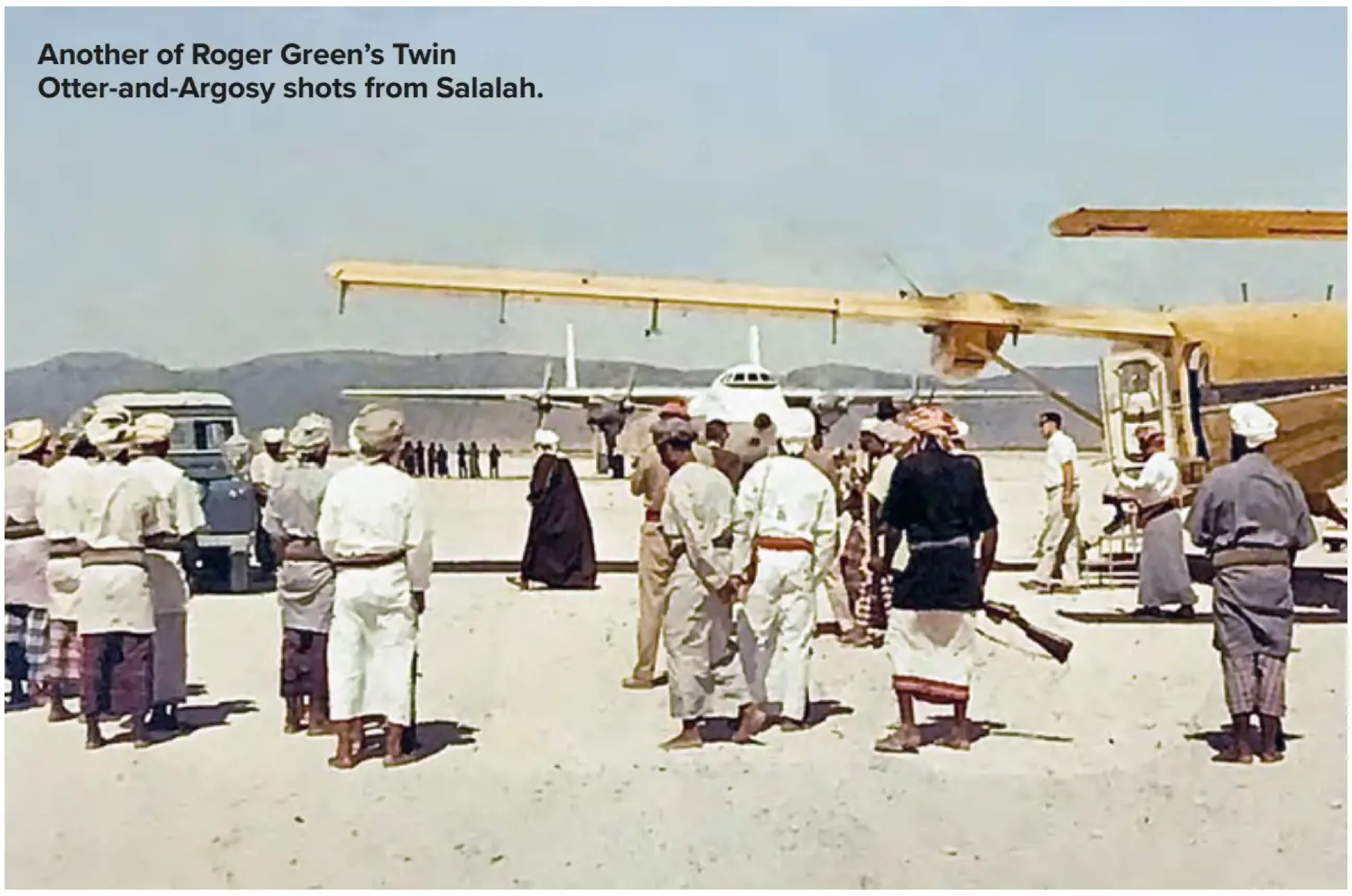
The editor reserves the right to edit all letters. Please include your full name and address in correspondence.

I have a black flying suit I inherited from my father dating from the late 1930s. It still has its original brass buttons, resplendent with the King's crown and RAF wings. Black flying suits were not common in those pre-war days but some photographs do show certain fighter pilots wearing them as they ran to their aircraft on a scramble during the Battle of Britain.

The suit is still in very good condition and occasionally gets an airing, most recently in a Tiger Moth built in 1942, the year in which I was born. Thus the combined age of the aircraft, the wearer and the flying suit exceeds 200 years. I would be surprised if today's equivalent flying clothing will have a useful life of nearly 90 years.

Tom Eeles

ABOVE: Tom Eeles in his father's 1930s flying suit, which fits him perfectly, just before flying in a Tiger Moth this summer.



Another of Roger Green's Twin Otter-and-Argosy shots from Salalah.

Q&A

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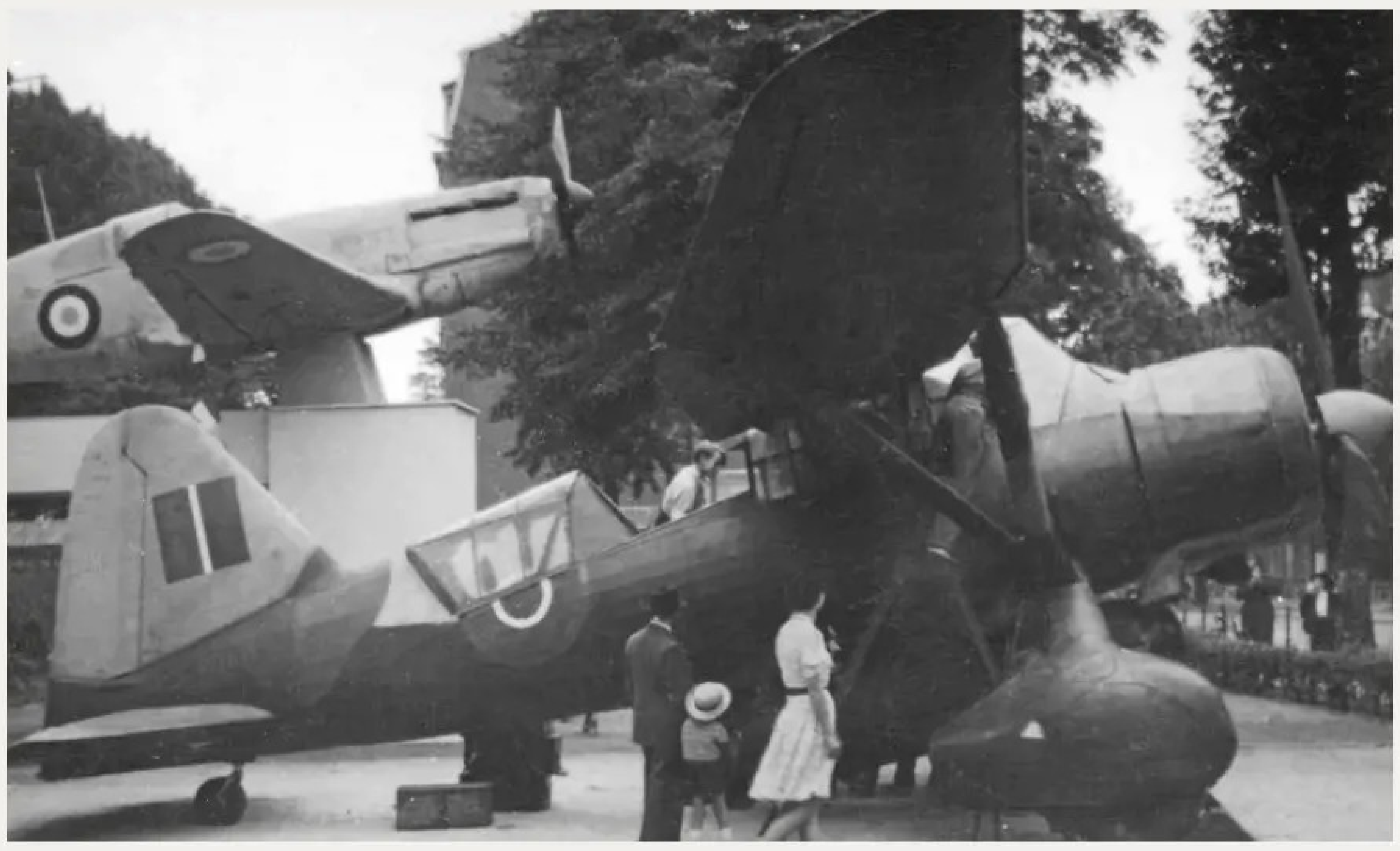
THIS MONTH'S QUESTIONS



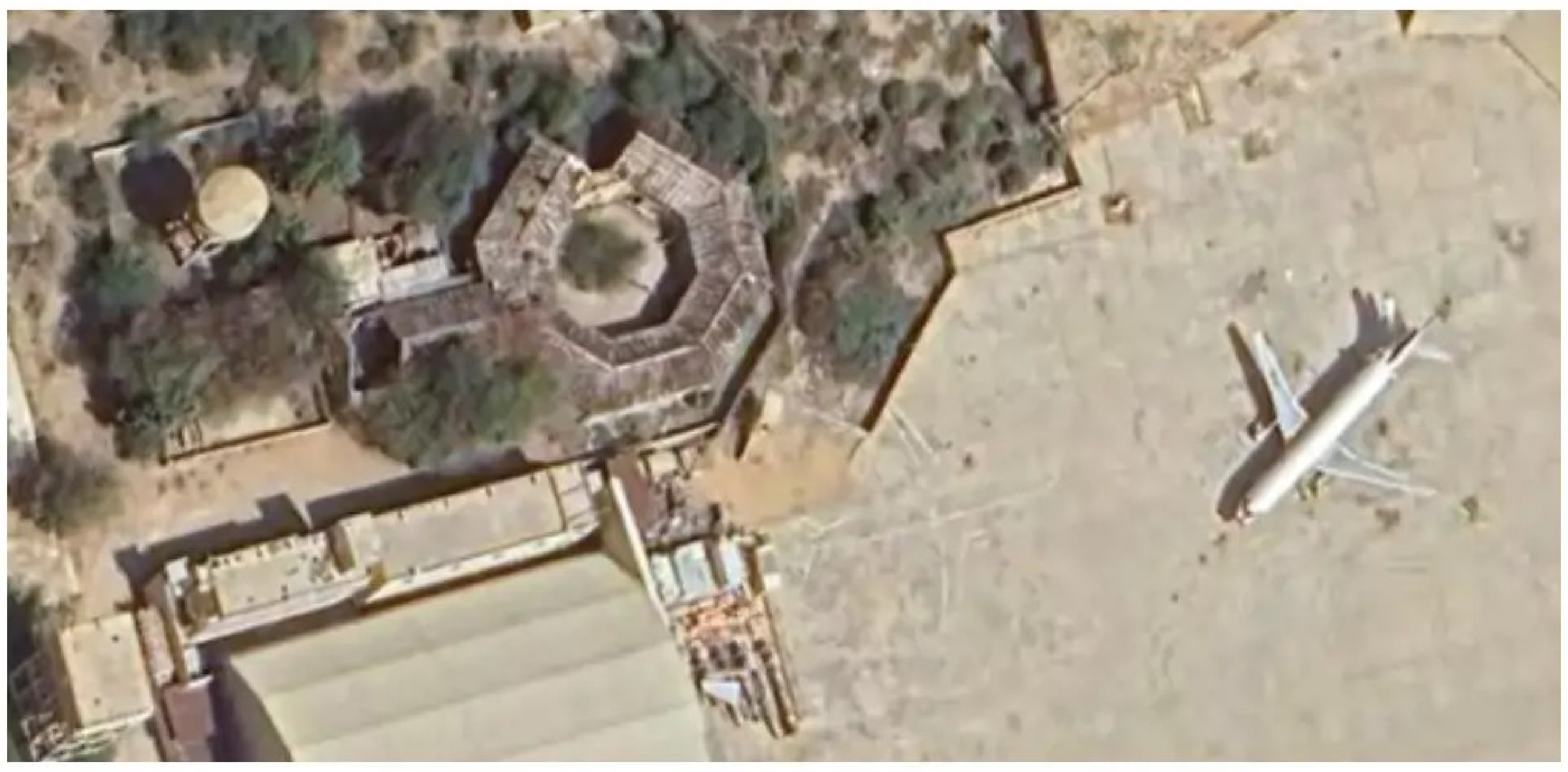
This Lysander IIIa (SD), which was displayed between two plinth-mounted Dewoitine D520 mock-ups on the Champs-Elysées in Paris during March 1945, was probably T1503. But does anybody know what happened to it? MUSÉE DE L'AIR ET DE L'ESPACE

Air Ministry exhibition aircraft

Q David Upton would like to know what happened to the collection of 'historic aircraft' which was held by the PR8 department within the Air Ministry's Public Relations Directorate for public display. The organisation staged exhibitions in Brussels and Paris in the immediate post-war period and one of the aeroplanes was special duties Lysander III serial T1503. Information shows the aircraft was taken on charge for display at Le Bourget in 1945 and struck off charge in 1946. It seems likely aircraft which were placed with PR8 for exhibition and publicity purposes were latterly surplus to requirements and may have been left 'in situ' after the displays. Does anyone have details on the types held by PR8 and their eventual fate?

Attacks on Cambridge

Q Can anybody help Tim Maitland regarding a photo-reconnaissance mission by the Luftwaffe using a Bf 109 for a planned bombing raid on Cambridge during World War Two? According to a friend, a nephew of Sir John Grandy, the mission was unsuccessful due to low cloud over the target, and a second sortie was expected the following night. This duly took place, but the RAF organised a very precise interception of the 109 on its return journey to its Dutch airfield. A Polish squadron was selected to undertake the mission and as the German aircraft descended to land, the Poles duly claimed to have destroyed the enemy fighter. Tim understands no further attempts were made to photograph Cambridge, although the city was bombed in 1940, twice in 1942 and again in 1943. He would welcome any details on this recce mission, including the date and the number of the Polish squadron assigned the task. A Bf 109 seems an unlikely aircraft to conduct such a task, so can this be clarified too?



Karachi's famous airship base?

Q Looking at some Google Earth views of Karachi Airport, Pakistan, Simon Pierce noticed a curious hexagonal building in an aircraft maintenance area just south of the western end of the main runway. Referring to historic photos, Simon believes this could be the hotel around the base of the R101 mast which was such a feature of the airport's inter-war period — if so, what an amazing surviving structure from the airship days. Simon would like to know if it is currently used as the roof appears to be intact.

THIS MONTH'S ANSWERS

Cartoon 'delta'

Q In the September issue, John Neimer sought a copy of a *Punch* cartoon showing a delta-winged bomber captioned 'You called, Master?'

A Robert Wells says it was a Brockbank cartoon which appeared in *Punch With Wings* published in 1960 by Arthur Parker. *[The rights are held by Topfoto and it's a bit pricey for us to publish here, but rest assured it exists — Ed.]*

Tooling curio

Q July's edition saw Francis Hanford, curator of RAF Halton's Trenchard Museum, querying the use of an unusual tool.

A Following a response from Mike Phillips in the September issue which identified the role of the tool as a metal cutter, Mike wondered what the acronym SUDAG on the handle stood for. Chris Yarboo suggests it could be Sud-Elektric Aktiengesellschaft, a large German industrial company involved in metal toolmaking during World War Two. However, Maximilian Meindl provides a more positive solution: it actually stands for Adolf Duisburg GmbH & Co of Remscheid, a defunct tooling manufacturer.

'Ben' Gunn sibling?

Q In the June issue, Remi Hodister wanted to know whether Boulton Paul test pilot 'Ben' Gunn was related to the wartime pilot Flt Lt Alastair 'Sandy' Gunn.

A Peter Moynihan, a 'down-under' reader and amateur genealogist, checked and says they were not related.

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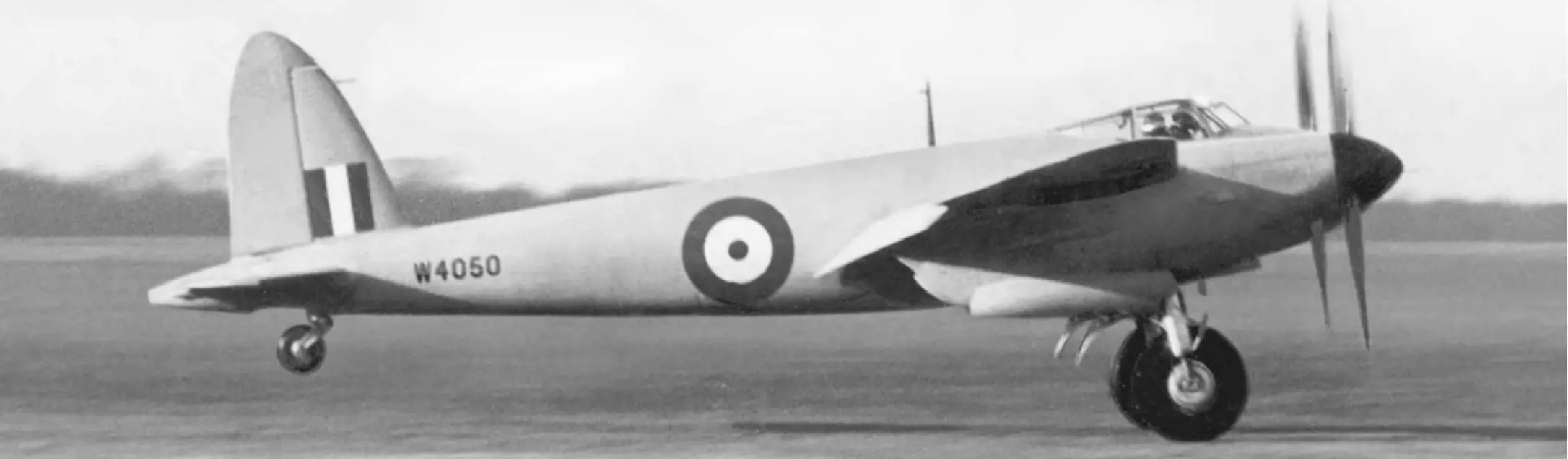
896/25

FIRST AMONG EQUALS

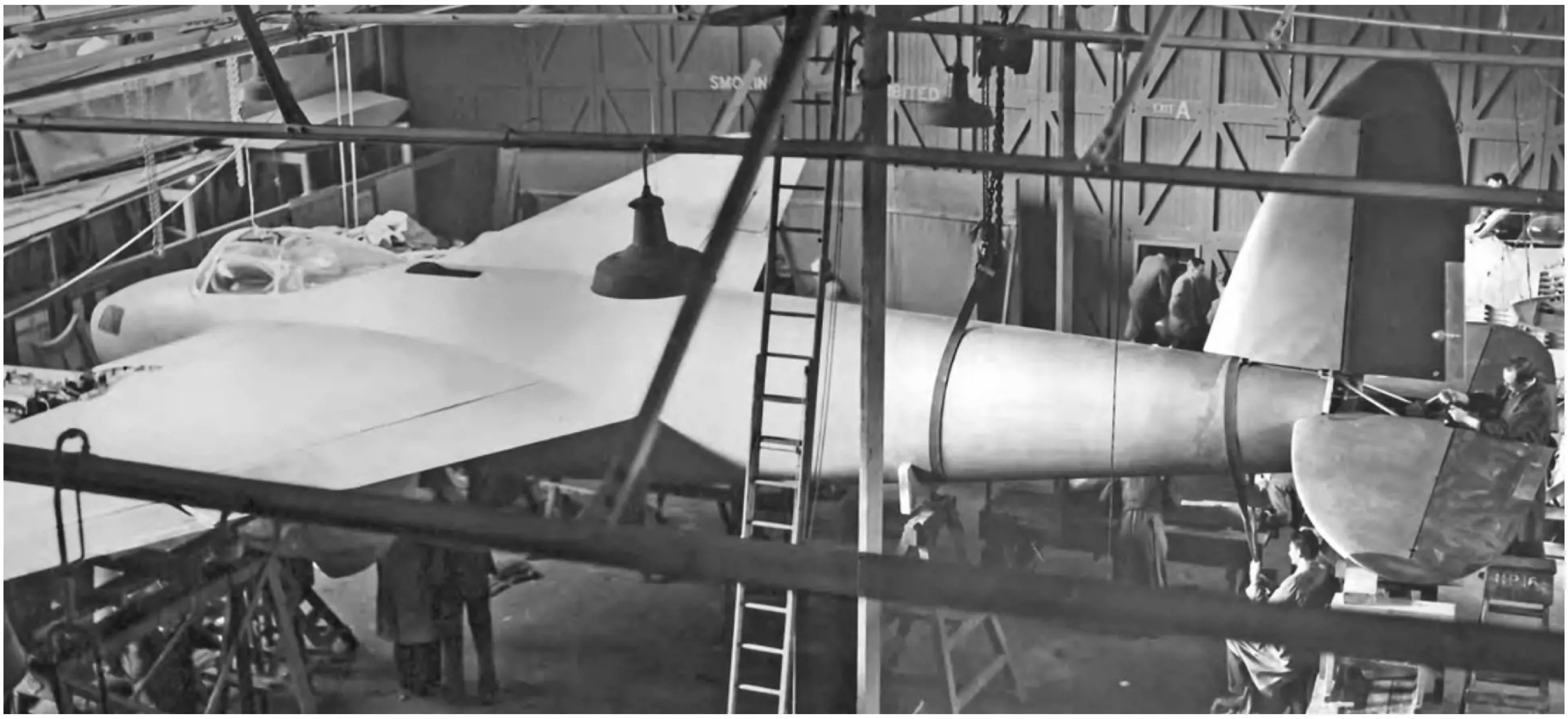
Eighty-five years ago, the prototype de Havilland Mosquito, W4050, made its maiden flight. Today that same aeroplane is the centrepiece of the de Havilland Aircraft Museum at Salisbury Hall, the site of its design and construction. With the benefit of years of research, what was W4050's contribution to the Mosquito flight test programme, and how was its remarkable survival assured?

WORDS: IAN THIRSK



Mosquito W4050 landing at Hatfield on 10 January 1941.

ALL BAE SYSTEMS UNLESS OTHERWISE CREDITED



Shown on this page are different phases of W4050's construction. The team engaged in the job worked long hours, 12-hour days becoming the norm.

It was in October 1939 that the nucleus of the Mosquito design team took over the 17th century manor house of Salisbury Hall near London Colney, five miles west of Hatfield. The choice was made for purely practical reasons, the site offering peace and security for the project plus a reduced risk of bombing. The main design and drawing office staff quickly followed and a hangar, disguised as a barn, was erected for construction of the initial prototypes.

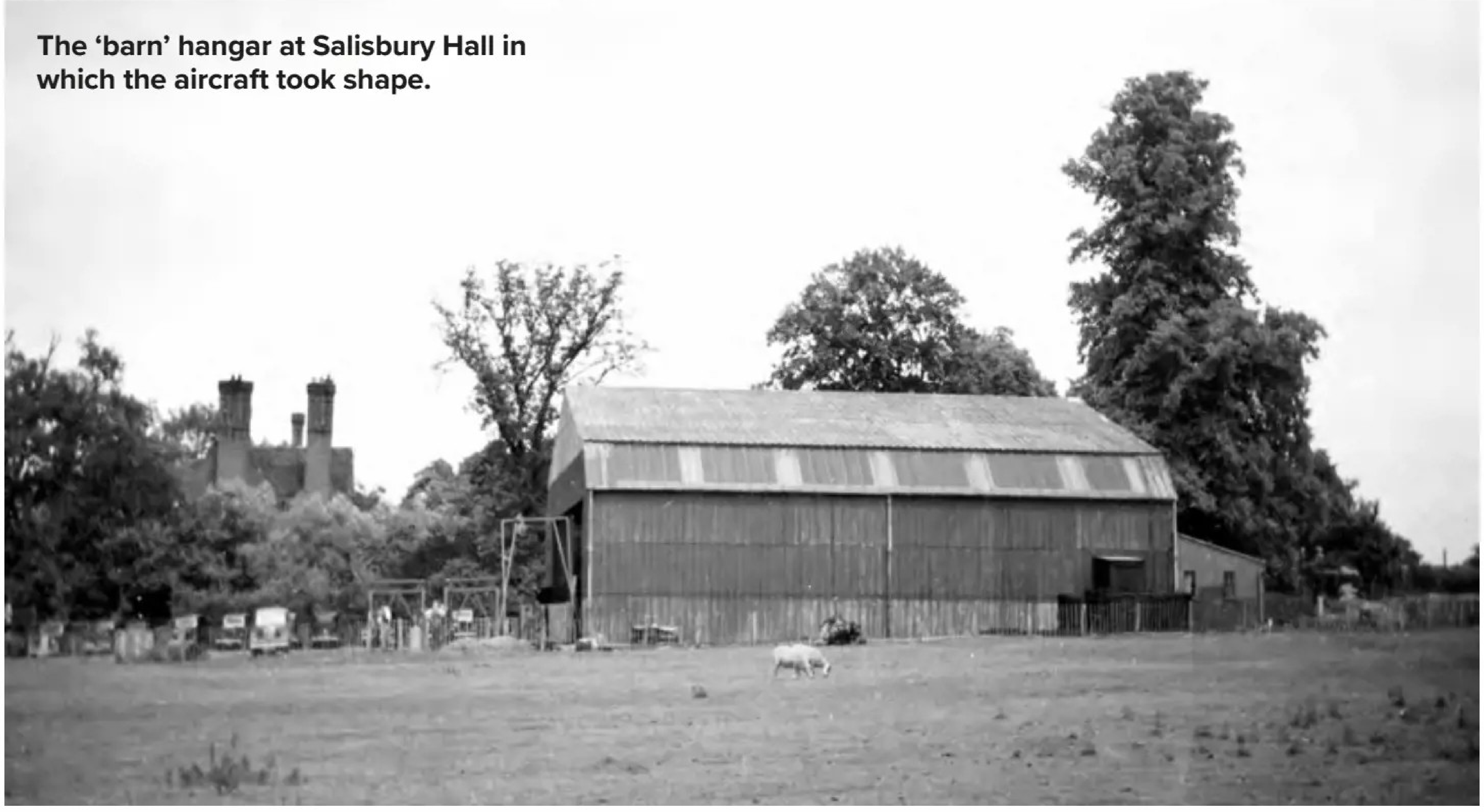
In a letter dated 1 January 1940, Lee Murray, de Havilland Hatfield general manager, wrote to W. S. Farren, the Air Ministry's deputy director of research and development, stating, "It is agreed that we will have to employ a fairly large proportion of skilled labour on the first prototype, but as we still have our Experimental Shop practically intact as regards labour, I do not anticipate any difficulty. Almost the whole structure of the aircraft will be made of wood, capable of being made on very simple jigs, so that I do not anticipate that this will cause any delay. We shall endeavour to produce many of the parts on wooden jigs, which will be made at the same time as the prototype is built..."

Costs were roughly estimated as being £4,400 for two Merlin engines, £8,000 to cover the airframe and equipment and £1,800 for spares, adding up to a £14,200 total.

The original design featured a 52ft 5in wingspan with tips of almost 'clipped' appearance — production aircraft would be 54ft 2in — plus a low-drag engine exhaust system with its outlet on the cowling side panels. The flaps were then single-piece structures which hinged down into the undercarriage nacelle.

Another notable feature of this first prototype was the inclusion of Handley Page 'slots' on the mainplane leading edges. To guard against potentially poor stall behaviour the Air Ministry had insisted slots be incorporated, these concerns being outlined in a letter dated 8 August 1940 from the Royal Aircraft Establishment's chief superintendent to the secretary of the Ministry of Aircraft Production: "We have generally regarded the wings of the Mosquito, with their high taper of 4:1, their thickness of 9% at the tips, and the shape of the section generally (Piercy-modified RAF 34), as being of such a form that they could well do with tip slots as a safeguard against a vicious stall. Recent tests on the locking of slots have shaken this view but have not altogether disposed of some misgiving as to behaviour of the Mosquito if the slots were dispensed with..."

Following Dunkirk, the Mosquito was officially cancelled but quickly reinstated, largely because its strategic material demands were very light. Meanwhile, the Salisbury Hall drawing office and construction teams completed the prototype in only 11 months from the start of detail design.


The 'barn' hangar at Salisbury Hall in which the aircraft took shape.

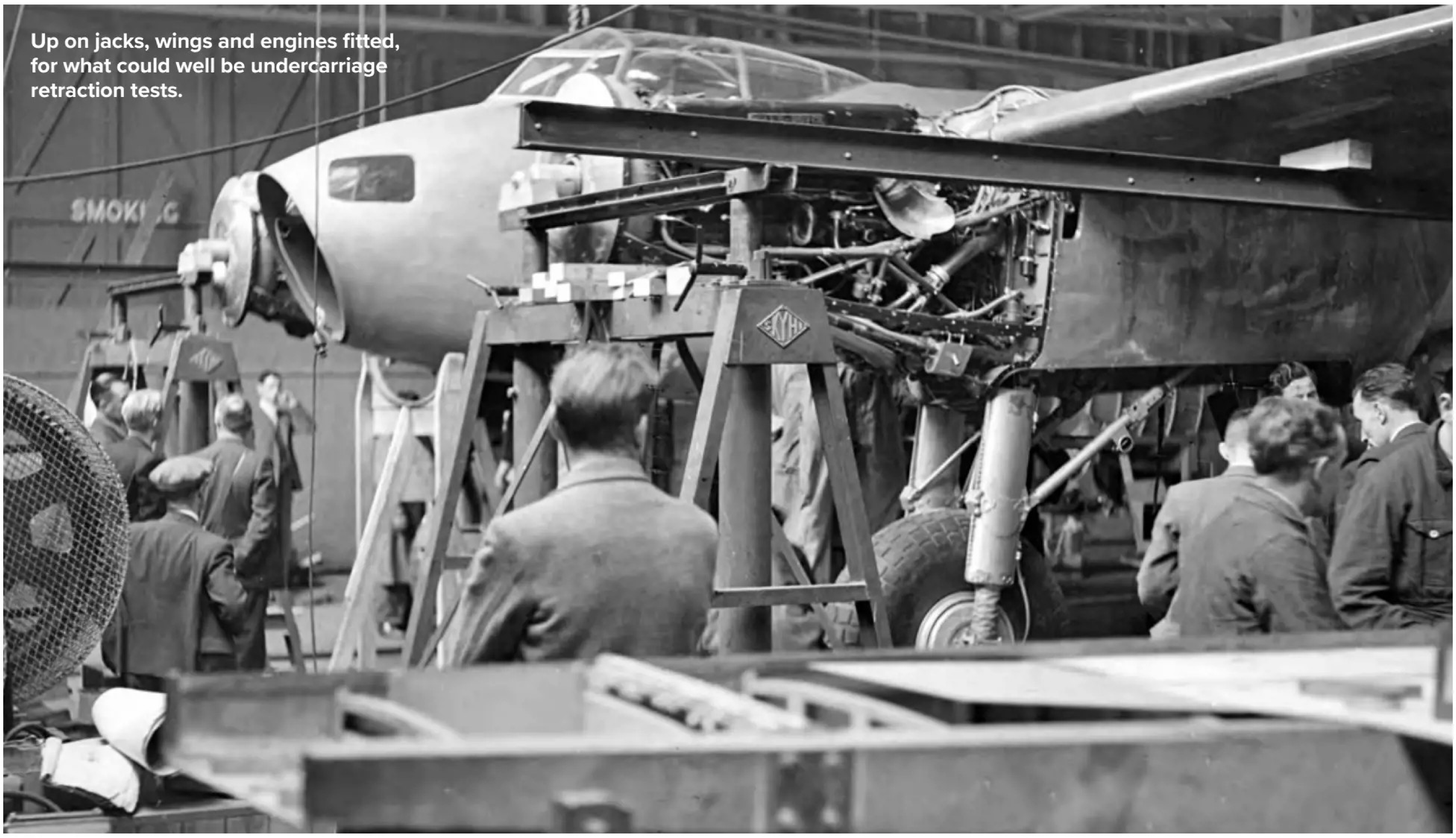
Fully assembled in its barn-like hangar, the aircraft was dismantled in October 1940 ready for transport to Hatfield and flight trials. Loaded aboard two Queen Mary trailers, it arrived at Hatfield on 3 November and was reassembled amid great secrecy in the former Tiger Moth paint shop at the St Albans end of the aerodrome. The building had an incendiary roof and a large anti-blast wall right across the opening.

> ***de Havilland said, 'It shows great acceleration power'***

Rolled out at Hatfield on 19 November 1940, the prototype was finished in an overall trainer yellow colour scheme and wore the company Class B registration E0234, the latter denoting a prototype aircraft without a full certificate of airworthiness ('E' being the prefix letter allotted to de Havilland). In accordance with Air Ministry requirements that it be completed "in skeleton form for flight testing to prove that the aircraft is satisfactory aero-dynamically", it would become the principal experimental Mosquito and, although outwardly resembling the bomber and photo-reconnaissance variants, it was not representative of either. Engine runs and fuel flow tests followed before the aircraft was towed to the factory erecting shop for weighing on 21 November.

Taxiing trials began three days later, E0234 immediately demonstrating a tendency to swing to port. This was initially put down to the port engine's high tick-over speed or binding of the starboard brakes, but it eventually transpired the tailwheel unit was not castoring correctly. Chief test pilot Geoffrey de Havilland Jr carried out several high-speed runs, afterwards reporting, "the machine shows great acceleration power; the tail comes up readily and directional control is good right from the start… the machine actually became airborne for a short time on the last run."

Accompanied by engine installation designer John E. Walker, Geoffrey de Havilland Jr made E0234's maiden flight


Up on jacks, wings and engines fitted, for what could well be undercarriage retraction tests.

The wing, with Merlin 21 engines already attached, being transported into the Hatfield site.

at 15.45hrs on 25 November 1940. During this 30-minute test, for which the Handley Page leading-edge slots were locked shut, take-off was recorded as "straightforward and easy". The undercarriage was only retracted after considerable height had been gained, observed by Walker through the nose windows.

The chief objective of this flight was to check engine installation and operation, which was felt to be "quite satisfactory", although starboard engine rpm needed to be increased by 100. Walker noted that the undercarriage doors remained open by some 4in when the gear was raised, this growing to 12in at 220mph, the highest speed to be attained on this first test. It was difficult to assess stability as the aircraft was flying left wing-low, a rigging adjustment being required. The canopy direct-vision quarter windows "showed great promise, as no draught enters the machine, even at 150 ASI", but it was recommended they be made to "fold back along the blister, making the view straight forward much better."

The second and third flights took place on 29 November, during which it was noticed the flaps did not go down absolutely level in relation to each other. Even so, the experimental aircraft pilot's test record said, "No undesirable features have been detected in flight regarding their operation". Despite stronger bungee cord having been fitted to the undercarriage doors, they continued to open as speed increased, which somewhat limited any assessment of general handling. On the plus side, rigging adjustments had cured the left wing-low tendency but the tailwheel was still not castoring correctly.

E0234 was allowed to settle down to fairly steady cruising conditions for the first time on 5 December. With engines set at 2,650rpm and plus 7 boost, the aircraft was flying at 240-250mph indicated when tail buffeting became apparent. To quote the pilot's test record, "It took on the form of a general 'shake' throughout the machine, being particularly noticeable on the control column: this probably accounts for the rev counter vibration and fluctuation."

To investigate this phenomenon, wool tufts were affixed using Bostik glue to both sides of the undercarriage nacelles, the lower surface of the inner wings and flaps,

Strops attached to the fuselage, it's about to be lifted into the air at Hatfield for mounting of the wing.

and the flap top surfaces above the nacelle. The tufts were supplemented by fillets attached to the exhaust outlets and trailing edges of the flaps, temporarily negating the latter's use. During the eighth flight two members of the design team actually crouched in the aft section of the rear fuselage to observe behaviour of the wool tufts through a circular window in the rear access hatch. They were able to see that severe stalling was taking place along the underside of the inner wings, and away from the nacelle rear sections; this disturbed airflow subsequently passed over the tailplane and led to buffeting. The wool tufts were also observed by test pilot Pat Fillingham who flew alongside and beneath E0234 in Hurricane I P3090, reporting the outer nacelle tufts "remained nicely streamlined."

The rev counter fluctuation was attributable to airscrew diameter, the original 12ft 6in propellers vibrating at three times their normal frequency, suggesting possible tip clearance trouble. These were replaced by smaller 12ft-diameter propellers, after which the vibration was greatly reduced.

◆

The prototype underwent extensive testing over the next three months prior to acceptance trials with the Aeroplane and Armament Experimental Establishment at Boscombe Down. The tail buffeting problem took some time to resolve, various solutions being trialled including installation of aerodynamic 'slots' or 'air straighteners', similar to those which had been fitted on the pre-war DH95 Flamingo airliner. They were of aerofoil section and designed to 'smooth out' the disturbed airflow before it passed over the tailplane. Initially tested on 11 December 1940, they made a slight improvement, but buffeting was still very evident. Several configurations were tried, the most effective consisting of slots fixed to the inboard sides of the undercarriage nacelles and span-wise on the under-surface of the inner wings. First evaluated on 15 December, they made a marked improvement up to 300mph.

Hatfield staff gather around for W4050's roll-out in November 1940.

Geoffrey de Havilland Jr flew E0234 to Langley on Friday 27 December for a demonstration of new aircraft types. During the return flight a new 'slot' arrangement was investigated, but this gave no improvement. To cite the experimental aircraft pilot's test record, "Vibration is considered bad, does not impart to the pilot a feeling of reassurance, and is a very fatiguing element."

Although its self-centring gear and thrust race were replaced, the tailwheel castoring issues persisted. Adjustments to the piston tube improved performance but it continued to stick on both grass and concrete surfaces.

The ducted exhaust demonstrated its own teething troubles, the system being prone to overheating. During the 14th test flight a smell of burning, plus blistering of the starboard engine inner cowling, led to the engine being shut down. Upon investigation the exhaust pipework had come adrift inside the cowling, being subsequently re-welded and 'sleeved' to provide greater strength. Cooling entry ducts were fitted to the cowling panel forward sections.

Despite comprehensive testing with aerodynamic 'slots', E0234's tail buffeting problems could not be eradicated. In an attempt to improve air separation from the undercarriage nacelle rear sections, de Havilland contacted RAE Farnborough for advice, forwarding a report on its findings to the RAE chief superintendent on 7 January 1941. The RAE developed a 1/6.5-scale wind tunnel model and recommended that extending the undercarriage

One of the first engine runs, the aircraft displaying Class B registration E0234.

A quarter to four on 25 November 1940, and Geoffrey de Havilland Jr makes the Mosquito's maiden flight.

nacelle beyond the trailing edge of the wing would solve the problem. The prototype's nacelles were lengthened in three stages, the first comprising of triangular plates extending the nacelle line rearwards and faired in on their aft sections. Test-flown on 3 February 1941, Geoffrey de Havilland Jr reported, "the general feel of the machine is still unpleasantly bad, especially in the neighbourhood of 300 ASI. The usual 'thumping' in the pilot's seat is most noticeable."

The second modification involved installing a pointed fillet, extending rearwards from the nacelle's upper section. The third consisted of a deeper-profiled fairing running from the lower nacelle line before curving upwards to meet the pointed fillet. Evaluated on 9 February 1941 with all aerodynamic 'slots' removed, the experimental aircraft pilot's test record reported, "There is no doubt that this modification has had the greatest curative effect of tail buffet to date and could be regarded as acceptable. Observation of wool tufts also indicates a far less turbulent flow away from the nacelles. The 'thumping' referred to in previous tests is still discernible throughout the machine but to a greatly reduced degree."

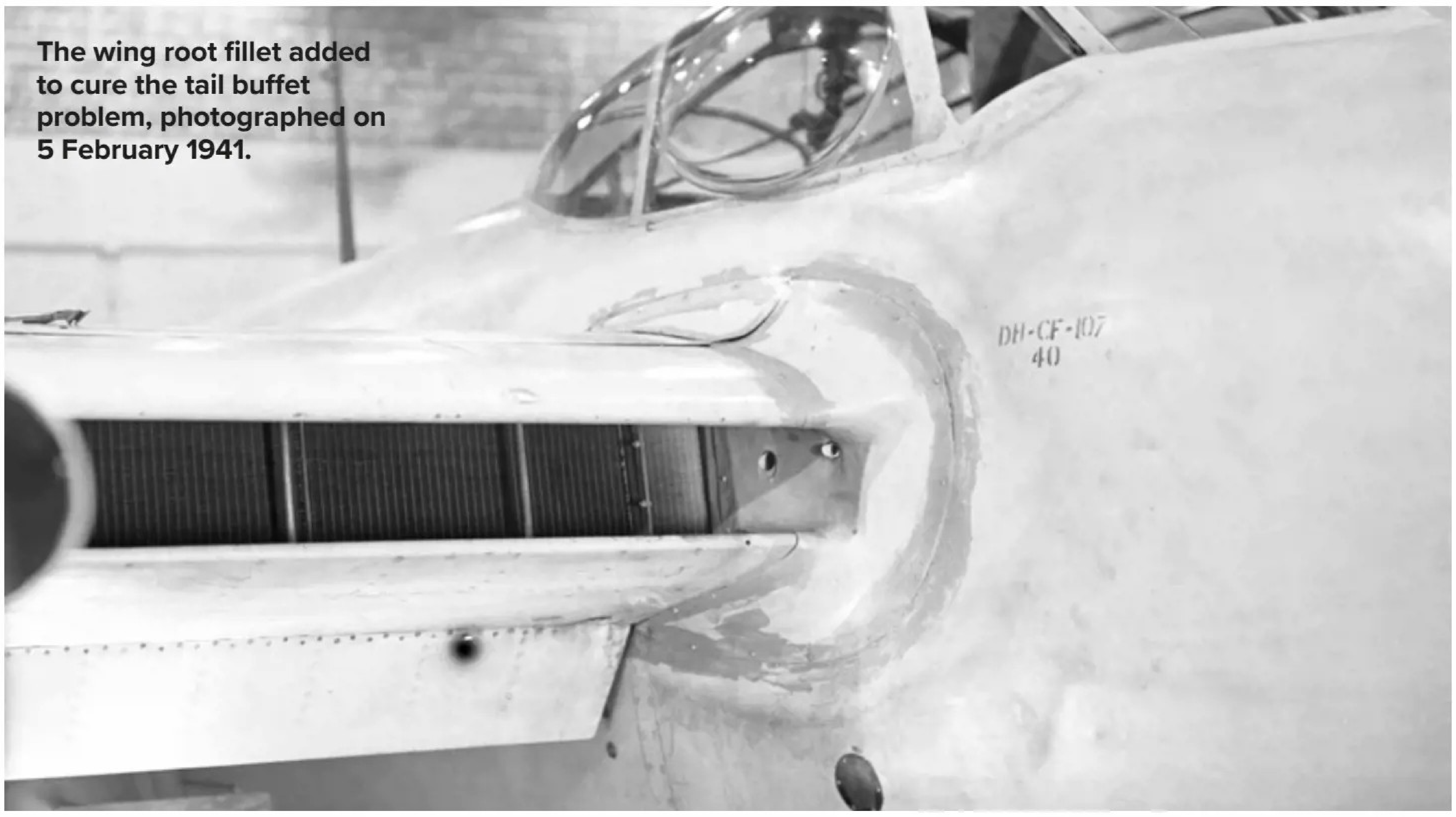
◆

By now, the Class B identity E0234 had been replaced by the official Air Ministry serial W4050. Speed trials had been conducted at weights of 16,000 and 17,000lb and were up to estimate, W4050 attaining some 386mph, easily outpacing a Spitfire. On 4 February 1941, J. E. Serby, assistant director for research and development at the Air Ministry, requested an update from the resident technical officer at de Havilland Hatfield, R. W. Fitch, regarding leading-edge slots on production Mosquitos. Fitch replied three days later stating, "it was found during early flights of the prototype aeroplane, that the stalling characteristics were satisfactory with the leading-edge slots made inoperative. At a later period during trials, the slots were removed, and, at present, there is no proposal that they should be refitted."

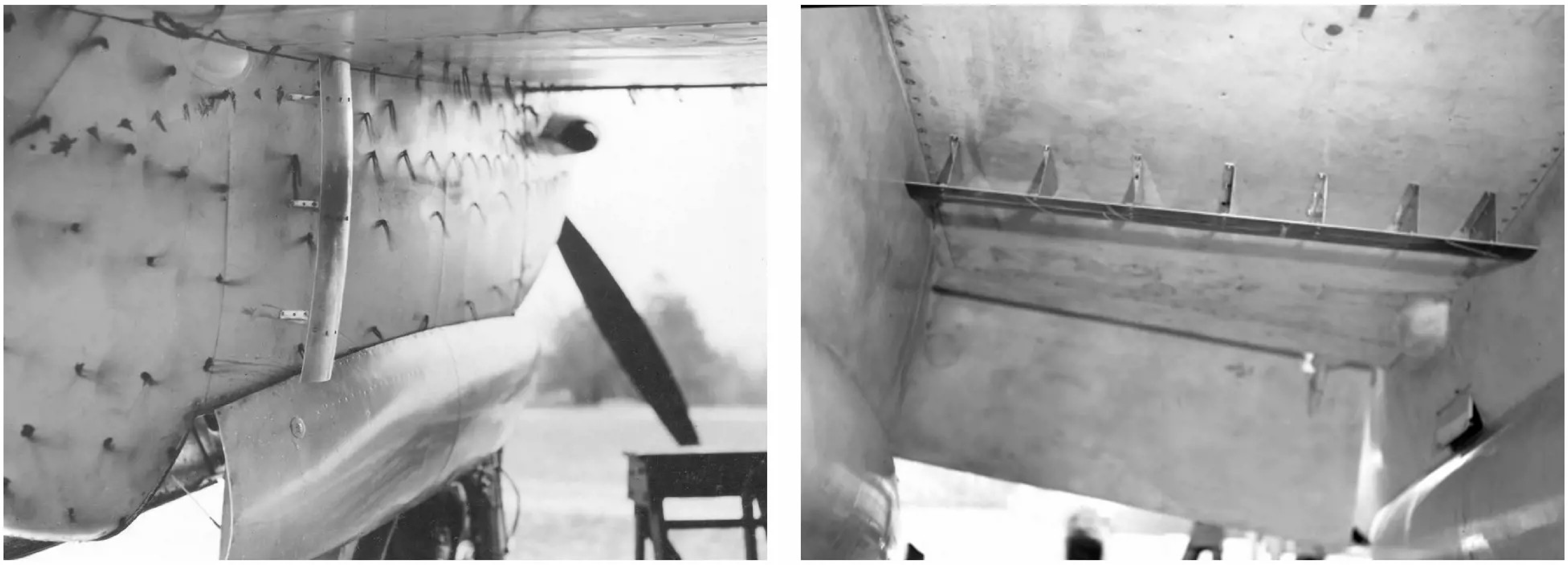
Of course, the slots were never actually removed from W4050. They were locked shut and sealed with fabric. Today they have been uncovered to show off this unique feature.

During the afternoon of 19 February 1941, Geoffrey de Havilland Jr, with DH senior aerodynamicist R. M. Clarkson as observer, delivered W4050 to Boscombe Down in readiness for acceptance trials by the A&AEE. Having completed 38 hours of contractor's flying trials, W4050 was now on CRD (Controller of Research and Development) charge. Prior to despatch, all nacelle extensions were removed and the aircraft reweighed. There appeared to be a lack of urgency to get the trials under way, coupled with doubts as to W4050's capabilities.

W4050 made a total of 12 flights between 19 and 24 February evaluating level speeds, climb rates, position



The wing root fillet added to cure the tail buffet problem, photographed on 5 February 1941.



The 'air straighteners' attached to the nacelles and the aerodynamic slots mounted on the wing undersides.

error and handling and stability. Ground handling was considered satisfactory but the castoring action of the tailwheel was, not surprisingly, criticised. The A&AEE pilots found W4050 a delight to fly with well-harmonised controls and exceptional manoeuvrability. Strangely, no real adverse comment was passed on the tail buffeting which was not considered serious. H. M. Garner of the A&AEE reported on trials progress to N. E. Rowe at the Ministry of Aircraft Production on 22 February: "The Mosquito arrived here two days ago, and we have been favoured with fine weather and done quite a number of tests. The top speed is about 390 mph which is very close to the speed obtained by De Havilland's."

Disaster struck on the evening of 24 February, in an incident which many felt would kill the Mosquito. In the hands of Performance Testing Squadron pilot Flt Lt Slee, W4050 was taxiing across Boscombe Down's rough aerodrome surface when, due to its ongoing castoring problems, the tailwheel jammed and the fuselage fractured. The damage was centred around the access hatch cut-out on the starboard side and was so extensive the fuselage had to be replaced. Senior de Havilland directors met with W. S. Farren, Air Ministry deputy director for research and development, at Boscombe, fearing the fracture and tailwheel problems would mark the Mosquito's demise. However, Farren made light of it all, saying, "You'll soon get that right. What interests me is this remarkable performance."

> *"Farren said, 'What interests me is its remarkable performance'"*

The fuselage of Mosquito PRI prototype W4051 was subsequently despatched from Salisbury Hall to Boscombe Down, replacing that of W4050. A de Havilland working party carried out the job, which included fitting a new needle-bearing tailwheel unit. On 14 March, Geoffrey de Havilland Jr flew W4050 back to Hatfield where various adjustments were carried out and the nacelle extensions refitted ready for the next series of A&AEE trials. These took place between 18 and 23 March, the Boscombe pilots being particularly impressed by the smoother qualities of the aircraft with extended nacelles. W4050 then returned to Hatfield to continue the development programme.

Further handling tests were conducted throughout March and April with and without the nacelle extensions in position. Longitudinal stability had been criticised by the A&AEE, J. E. Serby, assistant director for research and development at the Air Ministry, raising this in a letter on 11 March 1941 to chief designer R. E. Bishop: "It is becoming fairly clear that we will need a larger tail plane for the Mosquito — one that will shift the neutral CG to 0.04c. You have already shown to RAE proposals for a new tail plane but the increase is not large enough. I think you will agree that the best way out of the

A very rare image dating from the summer of 1941, with W4050 in camouflage, fitted with the short nacelles and original exhausts.

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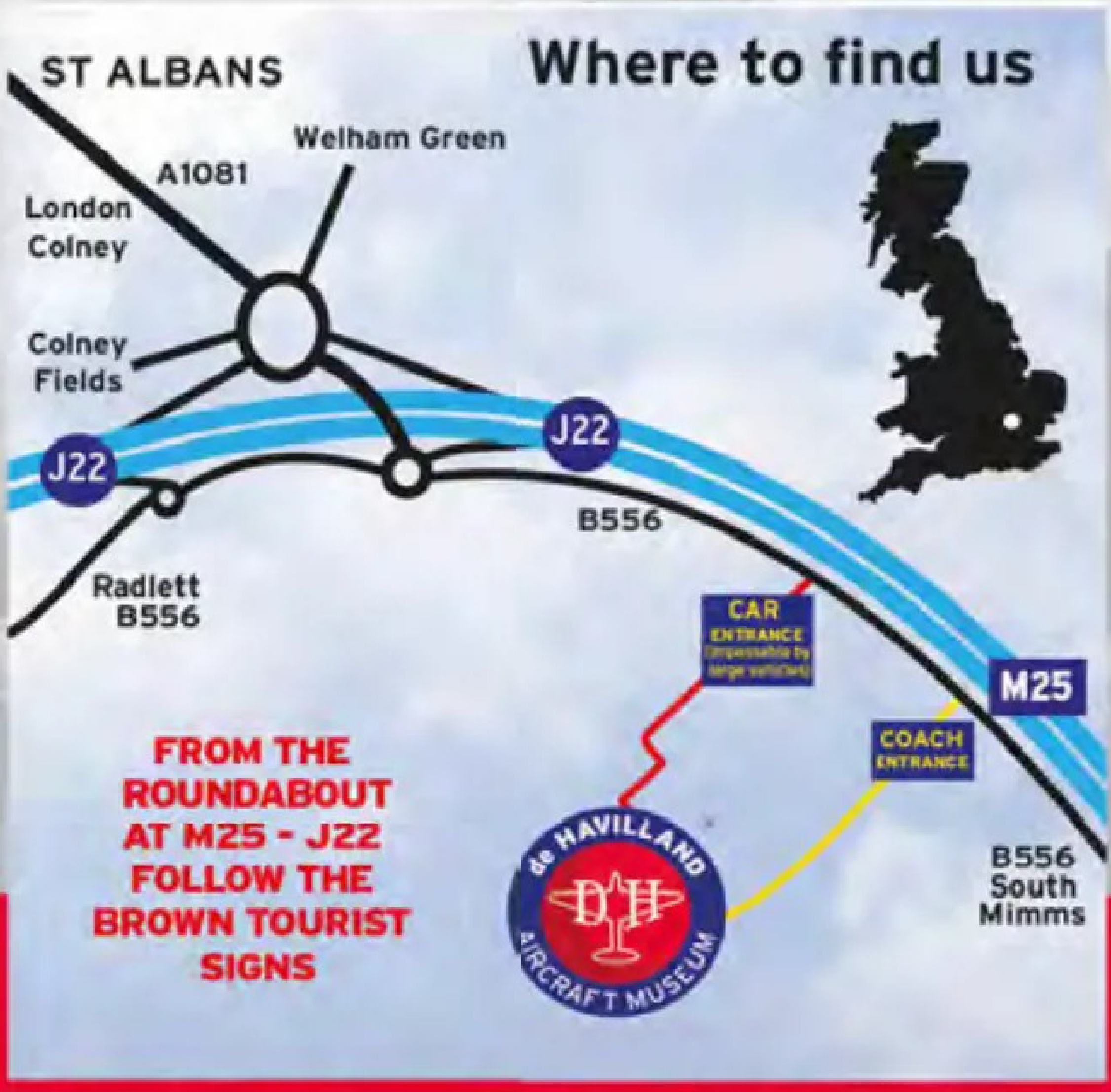
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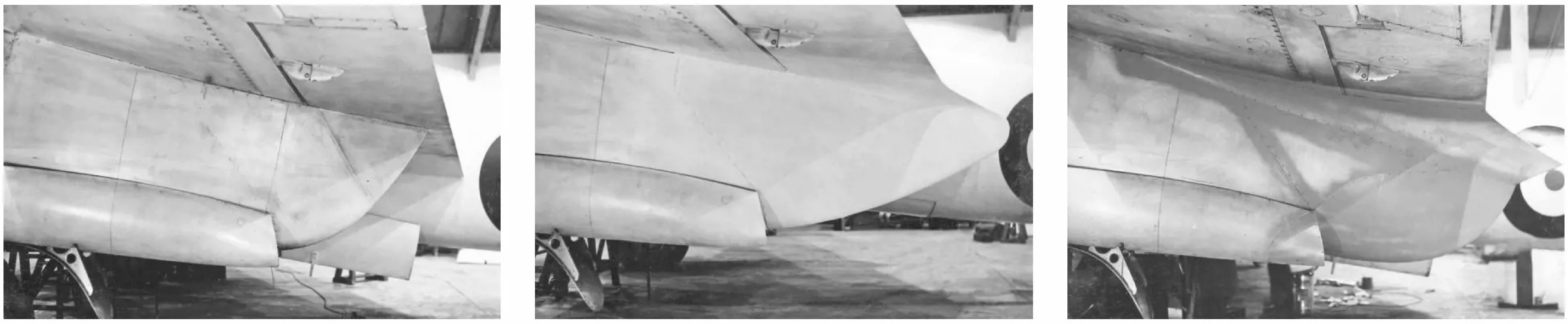


From left to right, three iterations of W4050's nacelles: the original configuration, the first extension, and the result of the second and third extensions.

situation would be to design afresh a tail of adequate size… I assume that you would consider this preferable to moving the engines forward."

W4050 flew in early April with a new tailplane of increased span, at 20ft 9in — thereafter referred to by de Havilland as the 'No 2 tailplane' — which appreciably improved matters. A display of new aircraft was held at Hatfield on the 20th of that month, including several American types. W4050 was fifth on the programme, carrying the number 5 on the rudder.

> *"It gathered data for the forthcoming fighter-bomber"*

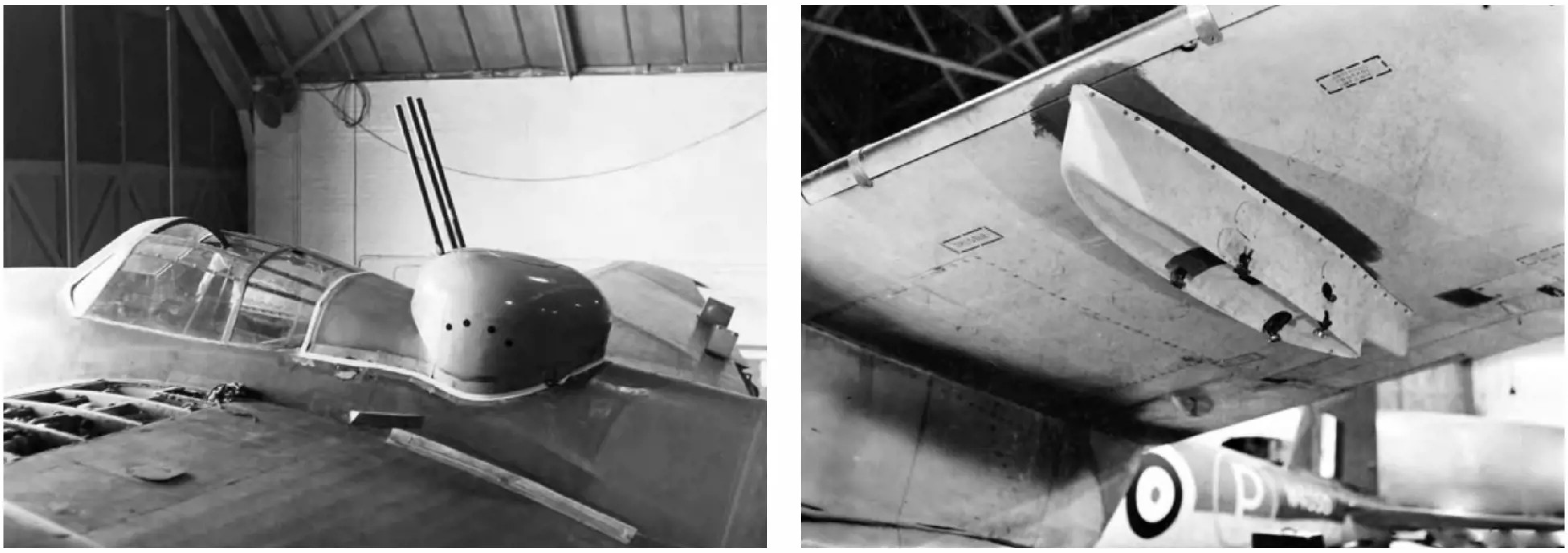
May saw W4050 returning to the A&AEE for further trials which included stability, radiator suitability and single-engine flying. In the course of the last of these the fuselage was again damaged, this time during overload landing tests. The damage consisted of a fracture just behind the trailing edge of the port wing, which was repaired through application of a large patch inside and out, slightly reducing the span of the port inboard flap.

In connection with the Mosquito turret fighter programme, W4050 flew with a wooden mock-up gun turret affixed to the canopy's aft section. To assess the turret's effect on handling and speed, seven flights were made over 23-24 July 1941. Aside from reduced level speed, restricted rear view and slightly increased tail buffet at the stall, the mock-up appeared to have little effect on general flying qualities. Other tests conducted during this period included opening the bomb doors at various speeds up to 280mph indicated. No change of trim occurred, but when dived to 360mph indicated, vibration became apparent and the doors moved considerably, the plywood skinning between their formers wrinkling. By this stage W4050's upper surfaces had been refinished in dark earth and dark green disruptive camouflage with large 'P' markings on the fuselage sides, the standard finish for all prototype service aircraft of the period.

The addition of underwing hardpoints and bomb carriers, each capable of carrying a 250lb bomb, took place in October 1941. Located at wing rib 8 and enclosed within streamlined fairings, they were flight-tested with and without bombs to evaluate their effect on performance. While handling was unimpaired, the carriers alone caused a performance loss of 5mph, rising to 9mph with bombs in position — all valuable data for the forthcoming Mosquito fighter-bomber version.

This marked the close of W4050's Merlin 21 flight test programme. It was dismantled and the wing returned to Salisbury Hall for installation of two-speed, two-stage-supercharged Merlin 61s. The Merlin 61 featured an intercooler radiator which — on the Mosquito — was located beneath the engine's forward section with its cooling intake immediately beneath the propeller. The additional supercharger extended the length of the engine, the spinners now protruding forward of the nose line.

The first Merlin 61 arrived at Salisbury Hall in February 1942 and by 25 March the wing and fuselage had been reassembled at Hatfield. With four-bladed propellers fitted, W4050 began engine runs on 17 June but the bespoke flame dampers became too hot and had to be removed, the engine's multiple ejector exhaust stacks exiting directly from the side cowlings. On 21 June John de Havilland made the first flight with experimental department manager Fred Plumb as observer. Many accounts cite the date as 20 June, but John de Havilland's logbook records



The mock-up turret, which was flown in July 1941 but not eventually proceeded with, and the bomb carrier from that October.

Once the Merlin 70-series powerplants had been fitted, W4050 reached its highest speeds. MICHAEL J. F. BOWYER

the 21st. As forecast, Merlin 61s significantly improved the altitude performance, W4050 reaching 40,000ft during the second flight, the highest ceiling yet attained by a Mosquito.

At this stage W4050 still had its original undercarriage nacelles and short-span tailplane, retrofitted for A&AEE trials the previous year, so tail buffeting was experienced. However, the longer-span 'No 2 tailplane' — plus production-shape extended undercarriage nacelles — were installed in late June/early July. The production length nacelles initially featured on fighter prototype W4052 and necessitated splitting the flaps either side of the nacelle extension and linking them with torque tubes.

With three-bladed propellers reinstalled, W4050's Merlin 61 test programme officially began on 14 July 1942. Flown by John de Havilland with Brian Cross as observer, comparative level speeds were measured — in both medium and full supercharger gear — with and without snow guards fitted to the carburettor intakes on the lower cowlings. Results were quite spectacular and on 19 July W4050, with snow guards installed, reached 433mph at 28,500ft. This was above estimates and it was believed the multiple ejector exhaust pipes were a contributory factor.

The Merlin 61 programme continued through to October and included fuel consumption tests plus climb and level speed trials with four-bladed propellers. During the latter, W4050 reached a spectacular high point in its career, achieving 437mph in level flight. This took place on 29 October and was the highest level speed attained by any Mosquito up to that time.

For the record, de Havilland aerodynamicist R. M. Clarkson recalled this feat some four months later: "We measured 437 mph at 29,000ft on the prototype Merlin 61 Mosquito on 18,000lb, but we have never been able to repeat it on this or any other aircraft. A maximum speed of 421 mph was reached on several Mk. VIIIs at 29,000ft on 18,000lb. We measured 424 mph at 26,000ft on 18,000lb on the first Mk. IX (Merlin 72). I think you would be quite safe to say [it is] the fastest operational aeroplane in the world."

This marked the close of W4050's Merlin 61 programme, the aircraft being grounded in readiness for the installation of Merlin 70-series engines. To be precise these were a Merlin 61 Special modified to Merlin 72 standard on the port side and a Merlin RM11 SM (Merlin 77) to starboard, both equipped with Bendix Stromberg carburettors.

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While the new engines were being fitted, W4050's wingspan was increased to 59ft for development work on new high-altitude Mosquito variants. From 8-29 December John de Havilland conducted tests to determine the effect on W4050's ceiling and rate of climb due to the more powerful engines and increased wingspan. Since W4050 was not fitted with a pressure cabin, for crew comfort the ceiling climbs were done at 2,650rpm, and in medium supercharger gear, to keep altitudes as low as possible. For comparative purposes, the last tests were conducted with W4050's wingspan reverted to the original 52ft 5in. Results indicated a maximum

Equipped with Merlin 61s in September 1942, showing the intercooler radiators and cooling intakes.

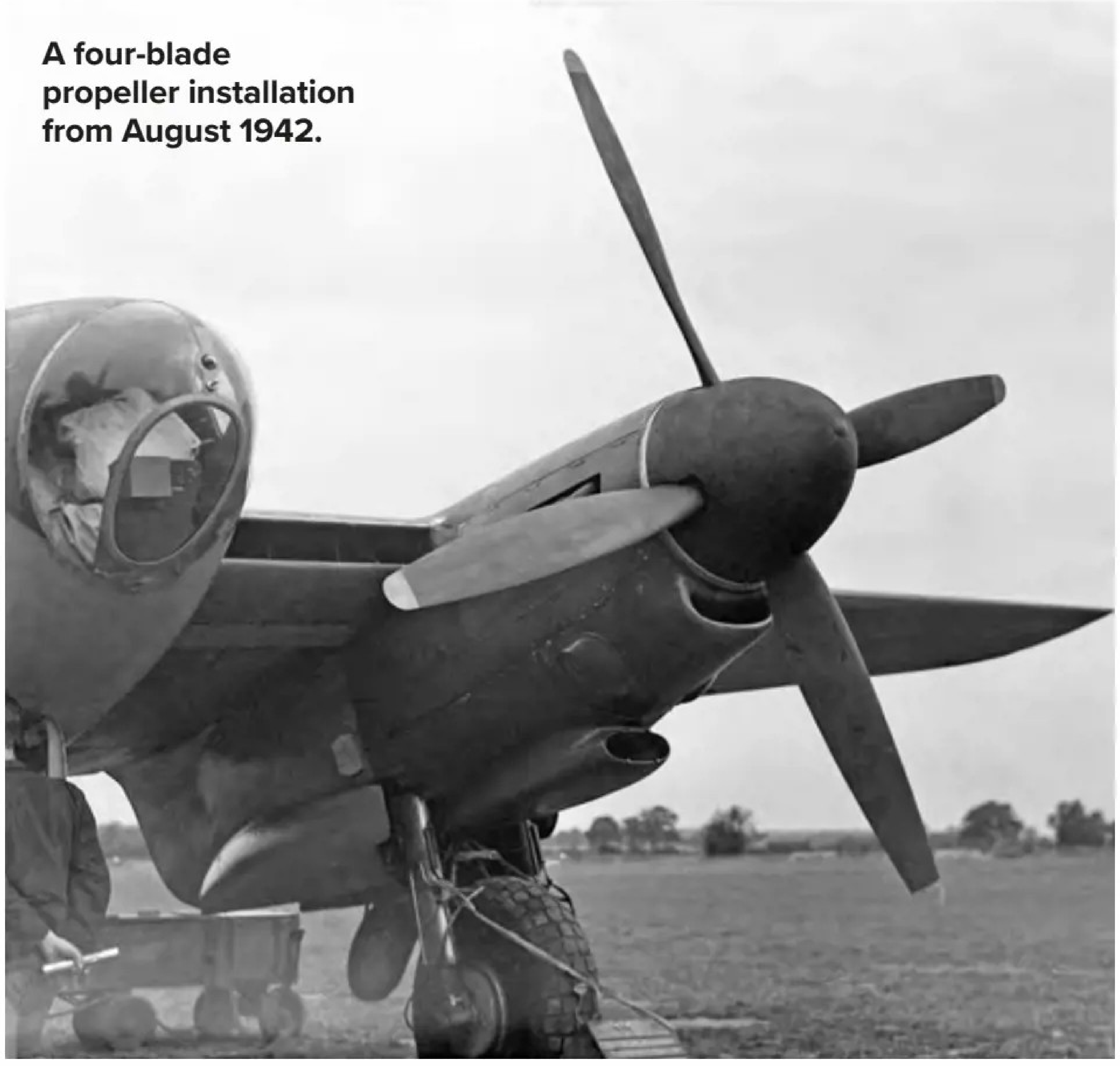
climb speed of 145mph with the standard wingspan, this lowering to 140mph with the 59ft span. The greatest altitude reached on test with the original wingspan was 35,800ft, rising to 36,300ft with the extended span. The official de Havilland report on these trials summarised the results thus: "It seems reasonable therefore, having regard to the experimental errors involved in the measurement, to say that the value of span stretching for ceiling and rate of climb on the Mosquito is perhaps 70 percent of the calculated theoretical effect. This may be summarised by saying that on the Mosquito an increase of absolute ceiling of about 200 feet per 1 foot increase in span may be expected."

> *de Havilland bought W4050 from the ministry for £25*

The Merlin 70-series test programme continued well into 1943, focusing on intercooler tests, level speed performance with three and four-bladed propellers, full-throttle climbs and comparative speeds with different types of multiple ejector exhaust stubs. As an example of the latter, on 17-18 March 1943 W4050 conducted trials to determine the difference in level speed between normal oval multiple ejector exhausts and those with 'D'-slot openings.

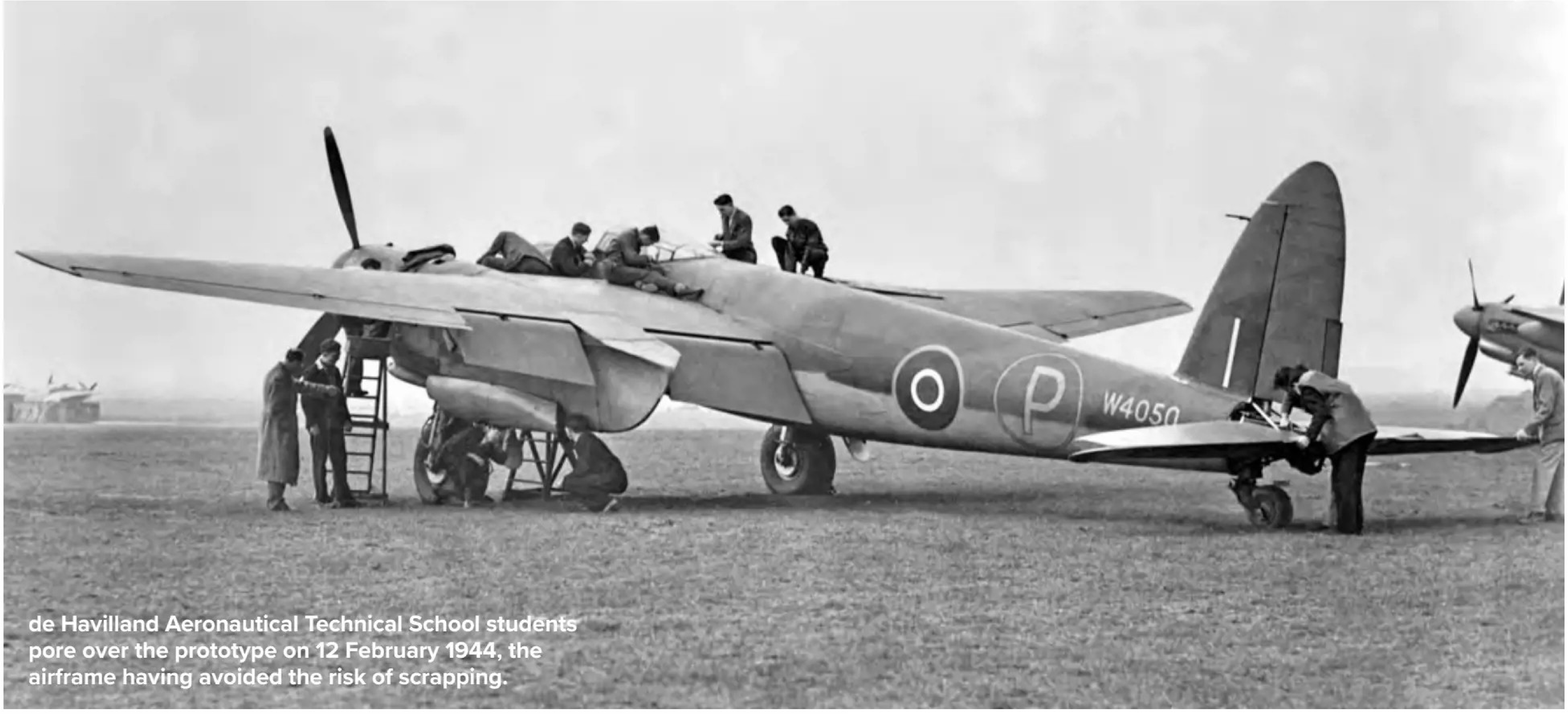
Further tests took place between 25 and 28 June, surviving DH flight test reports recording W4050's exhaust configuration: "Prototype Mosquito with exhausts as follows: Outer port — normal stubs. Inner port — common expansion chamber. Inner and outer starboard — 'D' slot with blinkers. Trouble was experienced with exhausts cracking; two outer port stubs were lost."

Following engine surge problems at high altitude, W4050 flew to Rolls-Royce at Hucknall in March 1943 for carburation tests. On allotment from the Controller Research and Development, it returned to Hucknall during May, this time for modifications to the engine supercharger diffusers and guide vanes. These cured the surging problems, and the changes were incorporated on production powerplants.


A four-blade propeller installation from August 1942.

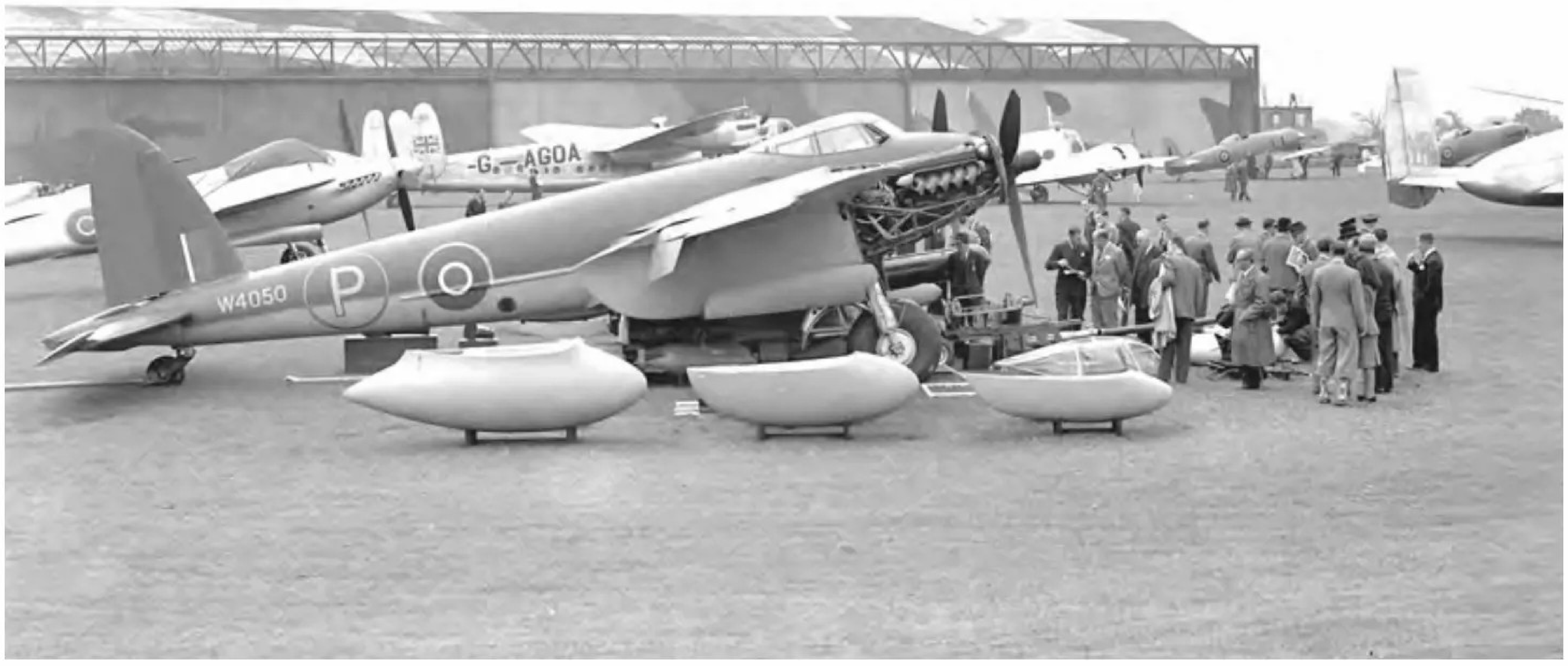
In the course of its Merlin 70-series development programme, W4050 reached 439mph during level speed trials, eclipsing the 437mph achieved on Merlin 61s. This is thought to be the highest level speed ever attained by a Mosquito, an endorsement of the basic design's soundness and no mean feat for the first aeroplane.

The latter part of 1943 was spent engaged on further exhaust stub tests plus the development of flame-damping shrouds for the two-stage Merlin Mosquito night fighter. Dick Whittingham, an inspector with the experimental flight test department at Hatfield regularly worked on W4050 and recalled this time well: "We went through a period when we put stub exhausts on W4050", he said. "They were made of stainless steel, which was a rare commodity during the war, and I believe some were of Inconel. They had so much trouble with these splitting down their weld joints like flower petals that they eventually welded up each stub out of a different material, and in a different way. They then said to the pilots, 'will you fly at low level, with the throttles wide open, to see how the stubs stand up to the pounding?' They obtained clearance from local



de Havilland Aeronautical Technical School students pore over the prototype on 12 February 1944, the airframe having avoided the risk of scrapping.

The 1946 SBAC show exhibit featuring W4050. *AEROPLANE*



anti-aircraft gun sites and, of course, all the pilots queued up for this. They enjoyed hedge-hopping and flying at two or three hundred feet."

Fortunately, Dick retained his wartime diaries which meticulously recorded — by serial number — every individual Mosquito he inspected and worked on. By this stage W4050's development career was drawing to a close and records for this period are sparse, but Whittingham's diaries indicate that the last flight took place in around December 1943. His entry for 7 January 1944 reads, "Spent most of the day on W4050 compiling a list of non-standard parts and doing a general survey prior to the aircraft being scrapped."

Clearly scrapping never occurred. Photographs of PRXVI MM308, taken at Hatfield on 11 February 1944, feature W4050 in the background minus exhaust stubs but still very complete. However, another well-known image captured the following day shows students from the de Havilland Aeronautical Technical School beginning to dismantle W4050. Additionally, the Air Ministry Aircraft Movement form for W4050 records it as withdrawn from active use on 18 March 1944.

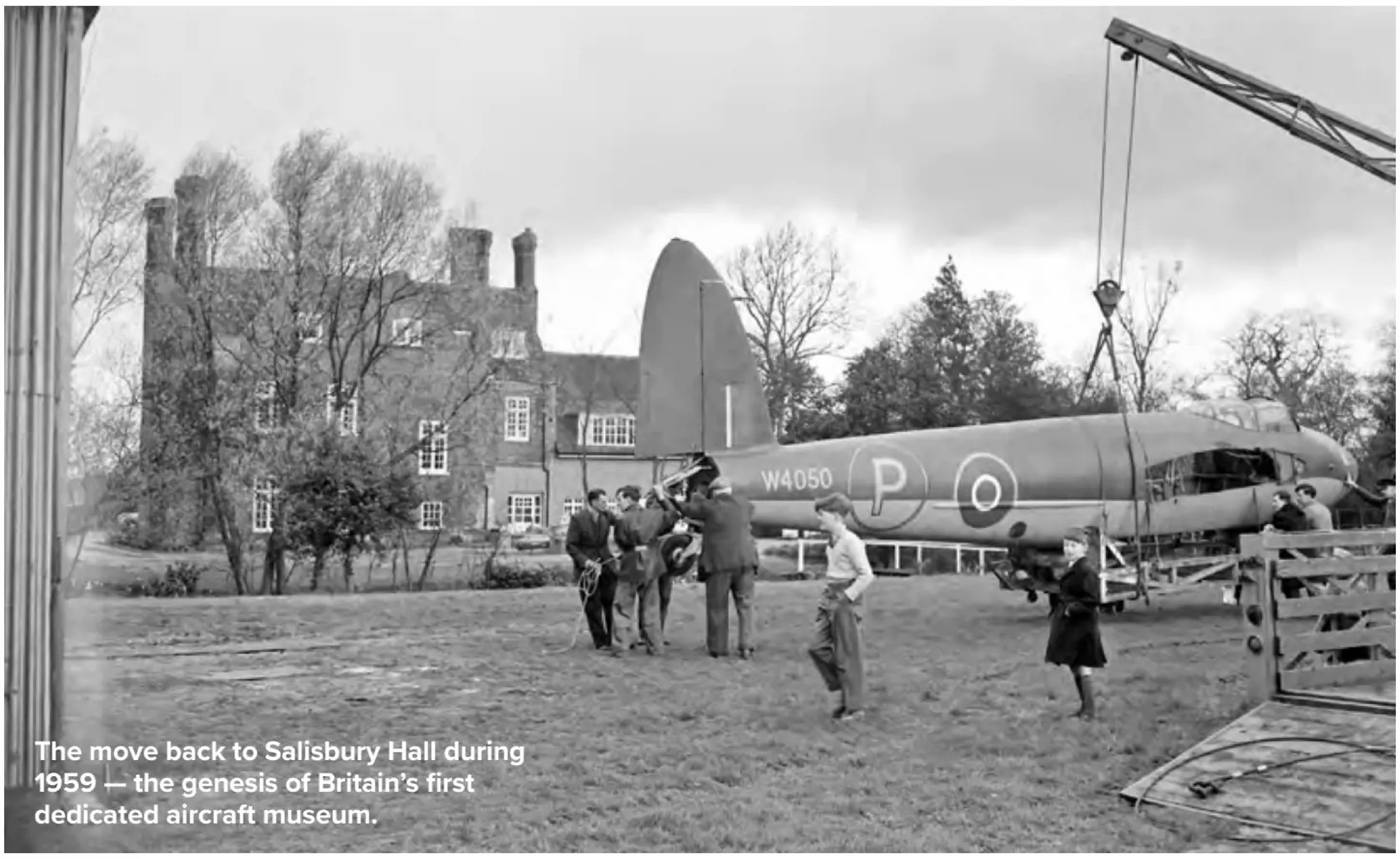
W4050 remained at Hatfield as an instructional airframe for de Havilland apprentices, the Merlin 70-series engines having been replaced by Merlin 25s. In 1945 the company commissioned Merton Park Studios to produce a publicity film on the Mosquito featuring the aircraft's origins, development, production and wartime use. Called *de Havilland presents the Mosquito*, W4050 appears several times playing itself while 'undergoing construction' and for pre- and post-'first flight' scenes. Generally speaking, these are quite authentic, with the exception that W4050 is not sporting its initial overall trainer yellow scheme.

❖

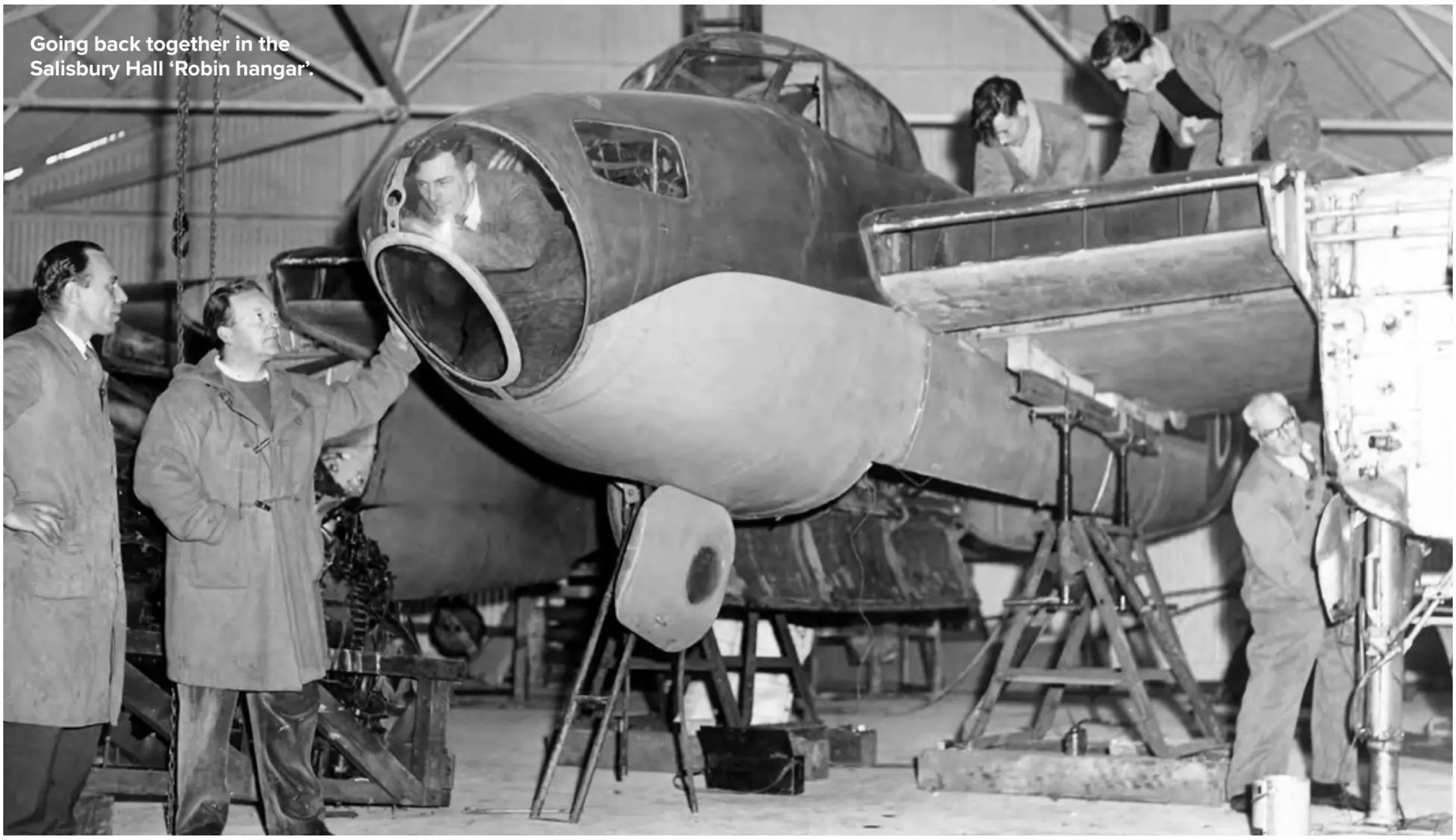
de Havilland purchased W4050 from the Air Ministry for £25 in late 1945. It was transported back to Salisbury Hall to continue its instructional role with the technical school students. When the school moved, W4050 transferred to the de Havilland public relations department at Hatfield, appearing in the static park at the 1946 and 1947 SBAC shows at Radlett. Assistant public relations manager Bill Baird arranged for W4050 to be put on display with an example of every piece of equipment carried by the Mosquito, demonstrating the type's great versatility — on a more humorous note, Bill even hired a kitchen stove for display among this range of hardware.

Plans to exhibit W4050 in a purpose-built facility at Hatfield came to naught and the aircraft remained outside on the airfield perimeter before moving to Panshanger. The ceasing of de Havilland's activities there saw W4050 being returned to Hatfield where it was kept under tarpaulins in the open transport yard. Due to airframe moisture ingress, Bill Baird had the aircraft moved to the Broughton factory where it remained until at least 1953. However, space became limited as the plant expanded, and Bill was instructed to burn W4050. Obviously this could not be allowed, so arrangements were made to keep W4050 in the company's Fiddle Bridge Stores at Hatfield.

Meanwhile, entering the picture was former wartime captain of marines Walter Goldsmith. He lived in Brookmans Park but was seeking a 'character property' to refurbish. Discovering Salisbury Hall, he arranged to restore the house under a Ministry of Works and Buildings arrangement,



The move back to Salisbury Hall during 1959 — the genesis of Britain's first dedicated aircraft museum.



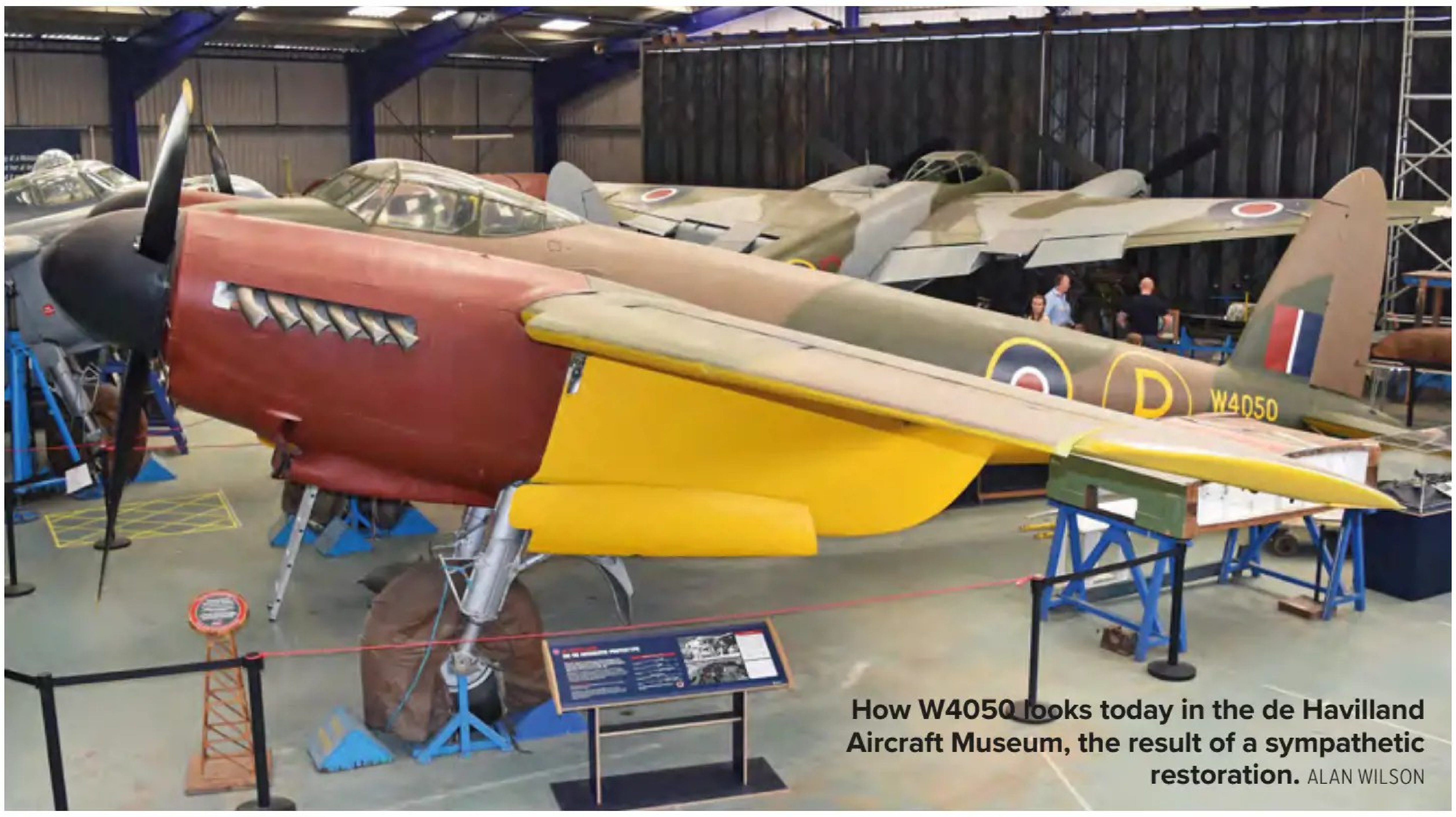
Going back together in the Salisbury Hall 'Robin hangar'.

a condition being that it was opened to the public each year. His neighbour was Mervyn Nixon, son of the ex-de Havilland managing director Wilfred Nixon. Goldsmith informed Mervyn of his plans to restore Salisbury Hall and the latter explained that the Mosquito had been designed and built there. Goldsmith planned to create a small display on its history and contacted Bill Baird requesting available Mosquito items to place on show. Bill showed them W4050 in the Fiddle Bridge Stores, which was really the birth of the present-day de Havilland Aircraft Museum.

Goldsmith found a suitable hangar to display W4050 while Bill Baird approached Sir Geoffrey de Havilland to ask if the company would be willing to fund the project. The answer was no, but shortly afterwards the director who'd originally ordered Baird to burn W4050 came into Baird's office. He understood Baird "wanted to raise some money to house the ashes of the aircraft he'd instructed him to burn?" Sir Geoffrey then offered to write to every sub-contractor involved in Mosquito production, explaining the situation and asking if they would like to help. As a result, £1,800 was raised, enabling the hangar to be erected on site and the floor concreted.

W4050 was prepared for exhibition and repainted in its original wartime camouflage scheme. Over time components had gone missing including the underwing side panels, engines, spinners, cowlings and propellers. Replacements were obtained from sources including de Havilland spares holdings plus RAF Hullavington, the latter providing two-stage Merlin radiators and oil coolers.

In 1959, W4050 returned to Salisbury Hall for the final time, being reassembled in its new hangar by staff from the de Havilland service department at Leavesden. It went on public display on 15 May 1959, becoming the museum's first exhibit. W4050 remained there for more than 50 years before relocation to the museum's larger hangar alongside Mosquito TT35 TA634 and FBVI TA122. Between 2010 and 2015 it underwent a detailed and protracted conservation programme sponsored by the Heritage Lottery Fund. The opportunity was taken to revert W4050 to the configuration in which it last flew, enabling the story of its significant contribution to Mosquito development to be finally — and properly — told.



How W4050 looks today in the de Havilland Aircraft Museum, the result of a sympathetic restoration. ALAN WILSON

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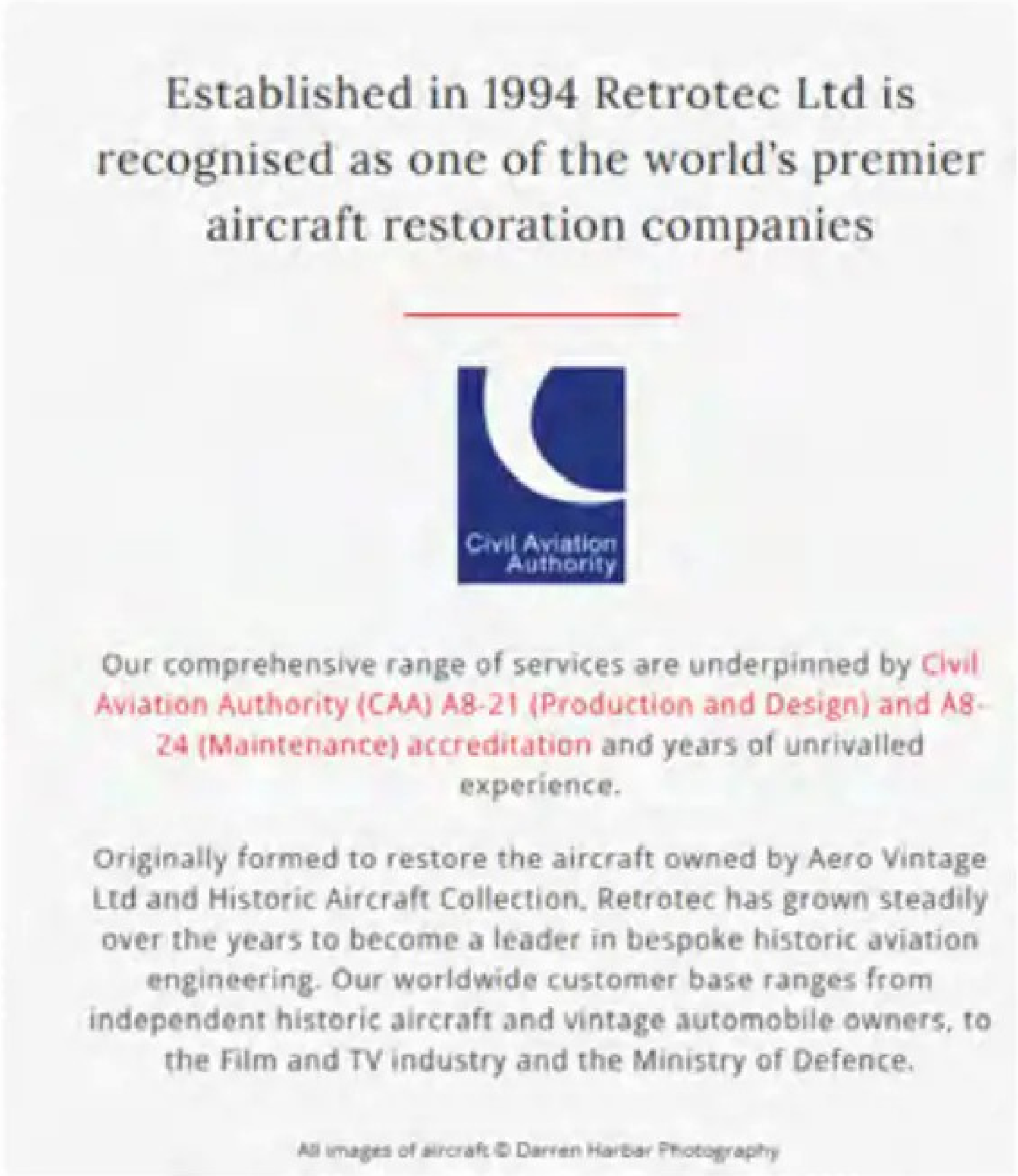

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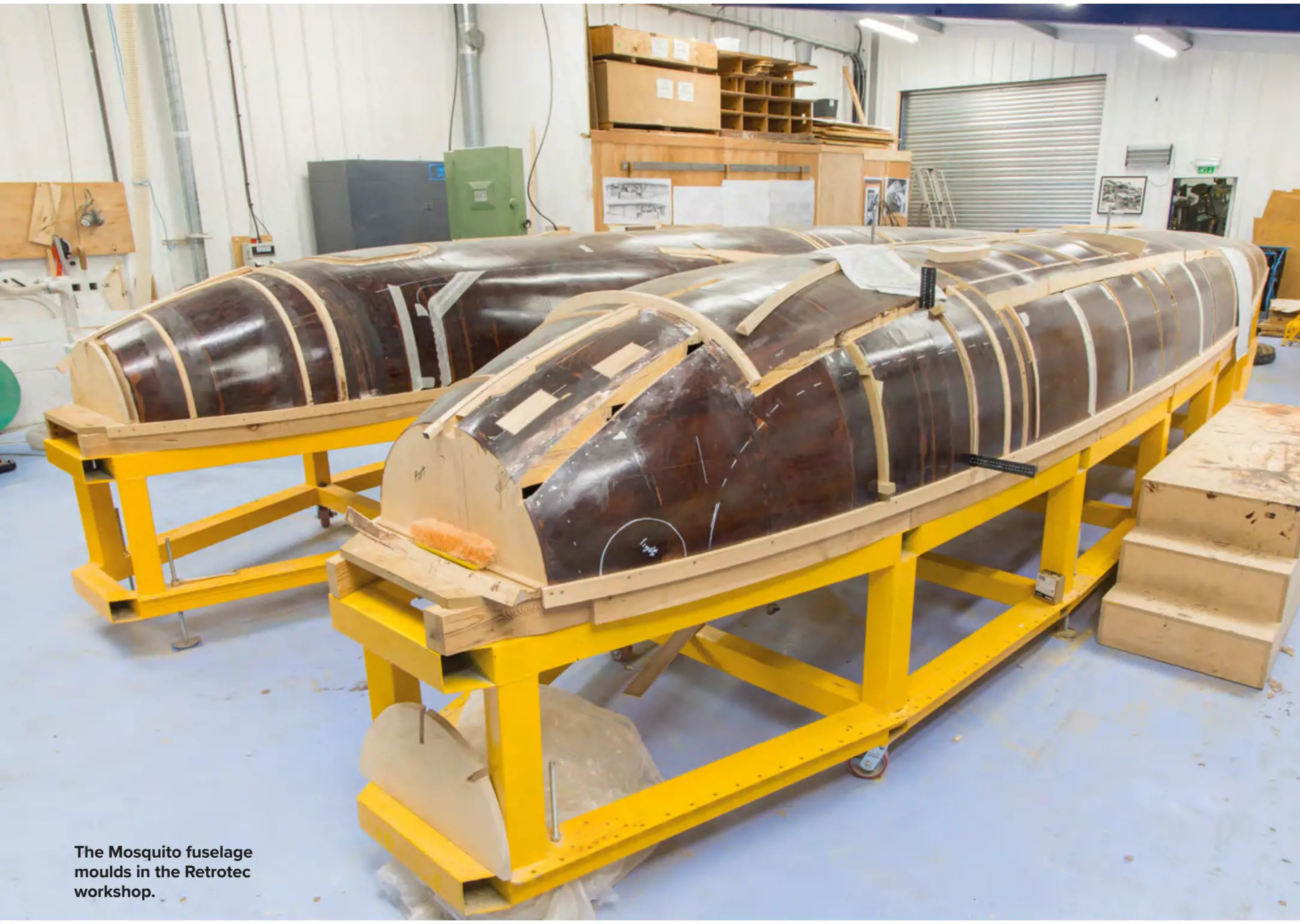

The Mosquito fuselage moulds in the Retrotec workshop.

HARD GRAFT

There will come a point, hopefully not too far away, when the Mosquito project being undertaken by Retrotec for The People's Mosquito will suddenly generate a new fuselage and seem that much closer to reality. Yet even to get to its current stage has seen the most painstaking workmanship

WORDS: BEN DUNNELL **PHOTOGRAPHY:** DARREN HARBAR

Paul Cole is chief woodworker on the project.

"When I first arrived there was hardly any project here. It was just a table with some hoops. Then I filled all the timber in and we shaped it, and we went from there, really..."

Paul Cole, chief woodworker at East Sussex-based Retrotec, was recalling his initial contact with The People's Mosquito. A lot has changed since. This programme to newly construct a flying Mosquito FBVI — which was inspired originally around the scant remains of an NF36 night-fighter, RL249, victim of an accident near RAF Coltishall in 1949 — has been gathering pace rather out of the limelight. The moulds which will be used to create the two halves of the wooden fuselage might seem the most tangible manifestation of its labours. In truth, they are but part of the story so far. It really needs to be viewed close-up to best appreciate what this means.

No doubt about it, the selection of Retrotec to take on the engineering side bestowed a significant chunk of credibility in one fell swoop. Its track record, outlined last month, in taking on the seemingly impossible tells its own story. So does its list of manufacturing and engineering capabilities and approvals. As TPM chairman and founder John Lilley says of the company's managing director Guy Black, "He is a stickler for accuracy and perfection in engineering. And one of the reasons we're working with him is that he *absolutely* nails the safety. Everything has to be done correctly. When we're raising public money, that's vital."

Looking at progress so far in the Retrotec workshop dedicated to the Mosquito, one gains a sense of the task's enormity. This, remember, is a home-grown programme, the decision having been made by TPM not to go down the New Zealand-based restoration route which has seen four splendid flying examples emerge from the facilities of Avspecs since 2012. Jigs and other items were obtained from New Zealand, and — as will become apparent — there has been a great deal of other collaboration with overseas-based companies, but it's all coming together in rural Sussex, effectively starting from scratch.

As a result, Paul Cole knows the Mosquito's unique construction, and the challenges it poses, better than most. "Obviously", he says, "you have the fuselage shell itself, with a 1.5 or 2mm inner skin of plywood done in panels of approximately 2ft by 5ft. They're spliced and glued together to give you a flat inner skin. Over the top of that you have other laminated frames, such as the pilot's door and other access panels, plus strengthening hardpoints to mount such accessories as the air and oxygen bottles, which are screwed through the plywood to the bulkheads to give you the inner shell. The empty spaces are then filled with about 0.5in of balsa wood. On top of that is bonded another skin of plywood, the 1.5 or 2mm.

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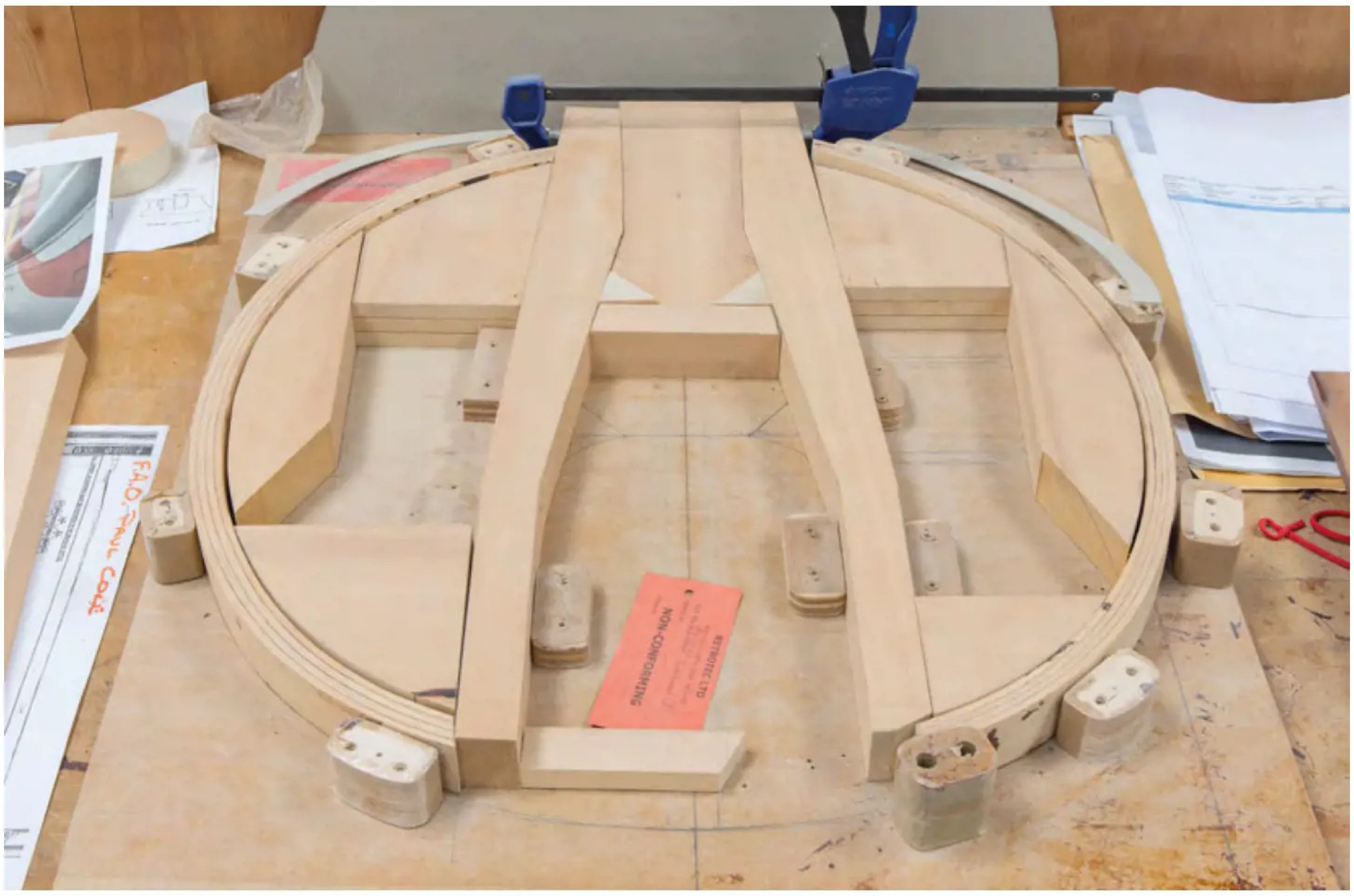
"We then wrap 4in stainless steel straps all the way round the half-fuselage shell, still on the mould. When that's all strapped down and glued, the the two half-shells end up at five-eighths of an inch thick — the two pieces of plywood and the balsa core. That's the shell of the fuselage, a bit like an egg. The strength of an egg is in its shape, and it's exactly the

A drawing for the cockpit floor and cannon bay support beams.



Frame seven is the last one in the rear of the fuselage supporting the tailplane, fin and tailwheel assembly.

same with this. There's always a 6in or 8in overlap on the joints between the individual pieces of longitudinal plywood that make up the shell of the aircraft, so if they ever failed they wouldn't fail in the same place.

“As it is now, it's sitting on its port and starboard sides. We'll lift them up and put them in a holding frame. Before bringing the two halves together, we'll put in all the plumbing and electrics, so the fuselage is finally fitted out before joining them together permanently — unlike a Spitfire, where you have to climb down the inside and get into little spaces. On the Mosquito you stand up and fit it out how you want. Nice and easy. It's a fantastic way of doing things, because de Havilland was quite clever in its thinking.”

> ***“We've fitted the wing pick-up jig inside the mould”***

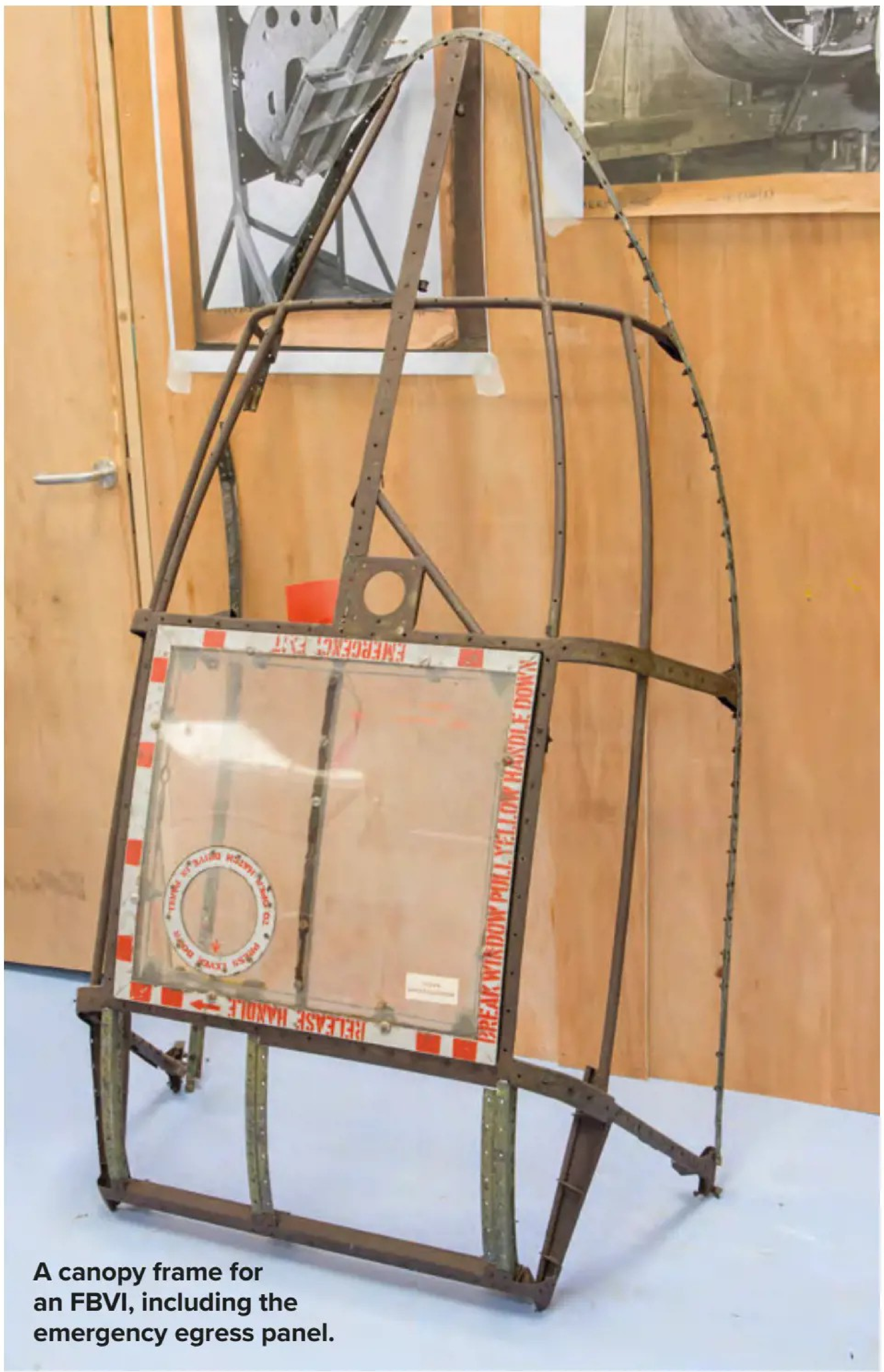
Paul noted how, not long before our visit, “We've fitted the wing pick-up jig which goes inside the mould. It's a steel bar with two pins sticking up, and the wing fixings go on it to fix the wing to the fuselage. They are measured exactly from the datum and they are the main points of the aeroplane for picking up the wing to give you the correct angle of incidence, so that will set the flying characteristics.”

That datum mark in the centre of the fuselage, from which horizontal and vertical measurements are calculated, is crucial. Everything is laid off it, and no wood is cut to size until it's absolutely necessary in order to avoid mistakes.

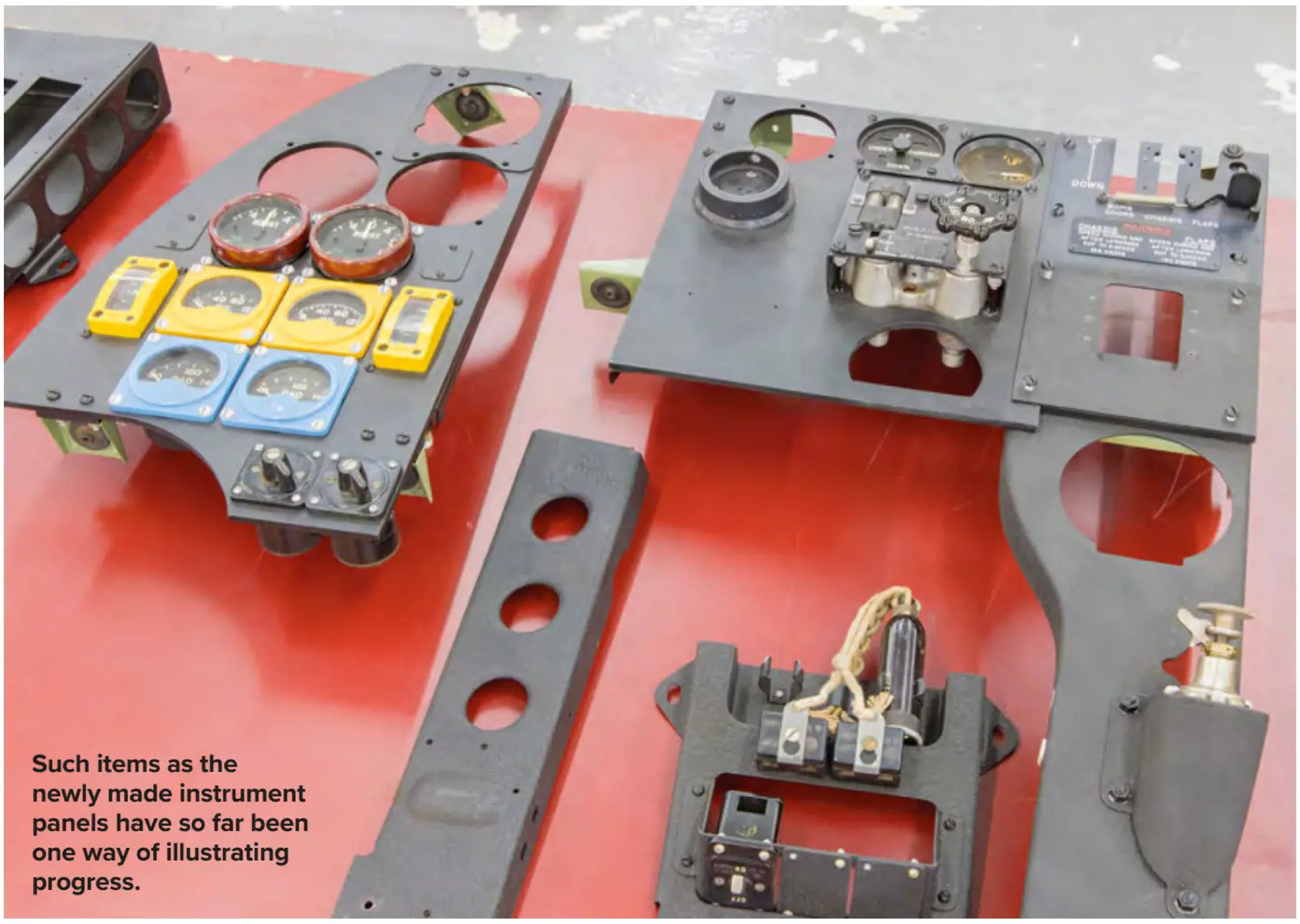
“Prior to that”, continues Paul, “I've been making up all of the inserts: bulkheads, laminations, access panel frames, floor beams and so on. There's a multitude of laminated frames in the fuselage itself — from the nose to the tail there are also seven main bulkheads. We've made all the seven main bulkheads and are now closing them up. Apart from that we've also made the hoops, which are laminated and add further support to the fuselage shell of the aircraft. They are all multiple pieces of spruce. The spruce hoop laminations are between 3.5 and 5mm thick depending on where it is on the aircraft, and curved, laminated together and glued with Aerodux 185.”

That provides a very definite historical connection for this aeroplane. Aerodux 185 is made by Hexcel at its plant in Duxford village, originally founded in the 1930s by Dr Norman de Bruyne. His development of Aerolite, a very strong, waterproof synthetic adhesive, was a major breakthrough for the builders of wooden aircraft, and it went on to be used in the manufacturing of Mosquitos and many other different types.

A high degree of complexity runs through the whole of the airframe. Paul cites one example: “The beams that take the big part of the torque from the wings for the bolts are a lamination. They're half-inch by 4in-thick pieces of spruce, and they're shaped so they have multiple facets — a really complicated shape”. And before he was interrupted for this



A canopy frame for an FBVI, including the emergency egress panel.



Such items as the newly made instrument panels have so far been one way of illustrating progress.

interview, he was tackling what he calls the most difficult of the Mosquito's bulkheads. Number four is located to the rear of the bomb bay, where the jacks for the bomb bay doors are. The two halves of it contain some 200 parts, because of the number of small components within.

That's just one of the myriad absorbing details under the skin of this project. The plywood is another. "Most of the aeroplane", says Paul, "is made of a 90° plywood. With most plywood, you have glued veneers with the grain going one way and then another veneer with the grain at 90°, and made up in layers to give it the necessary strength so it doesn't tear. But from bulkhead number five forward, most of the panels — which are made up of about 5ft by 2ft panels all scarfed together — are 90° plywood. Everything behind that, back to the tail, is made up in 45° veneer laminations, or spiral ply as they call it, which no-one in the world makes any more. Nobody uses it.

"Before the war, it was used for gliders and the British government used to buy it from a company in Germany. When the war started they wouldn't sell it to us and, obviously, we wouldn't buy it from them. We had to manufacture this 45° ply ourselves. What they did, because they didn't want anybody else getting their supplies from Germany, was have the RAF bomb the factory, so it never produced again until after the war. Then it started up again and was used on gliders. Just recently, in the past 10 years, that mill closed.

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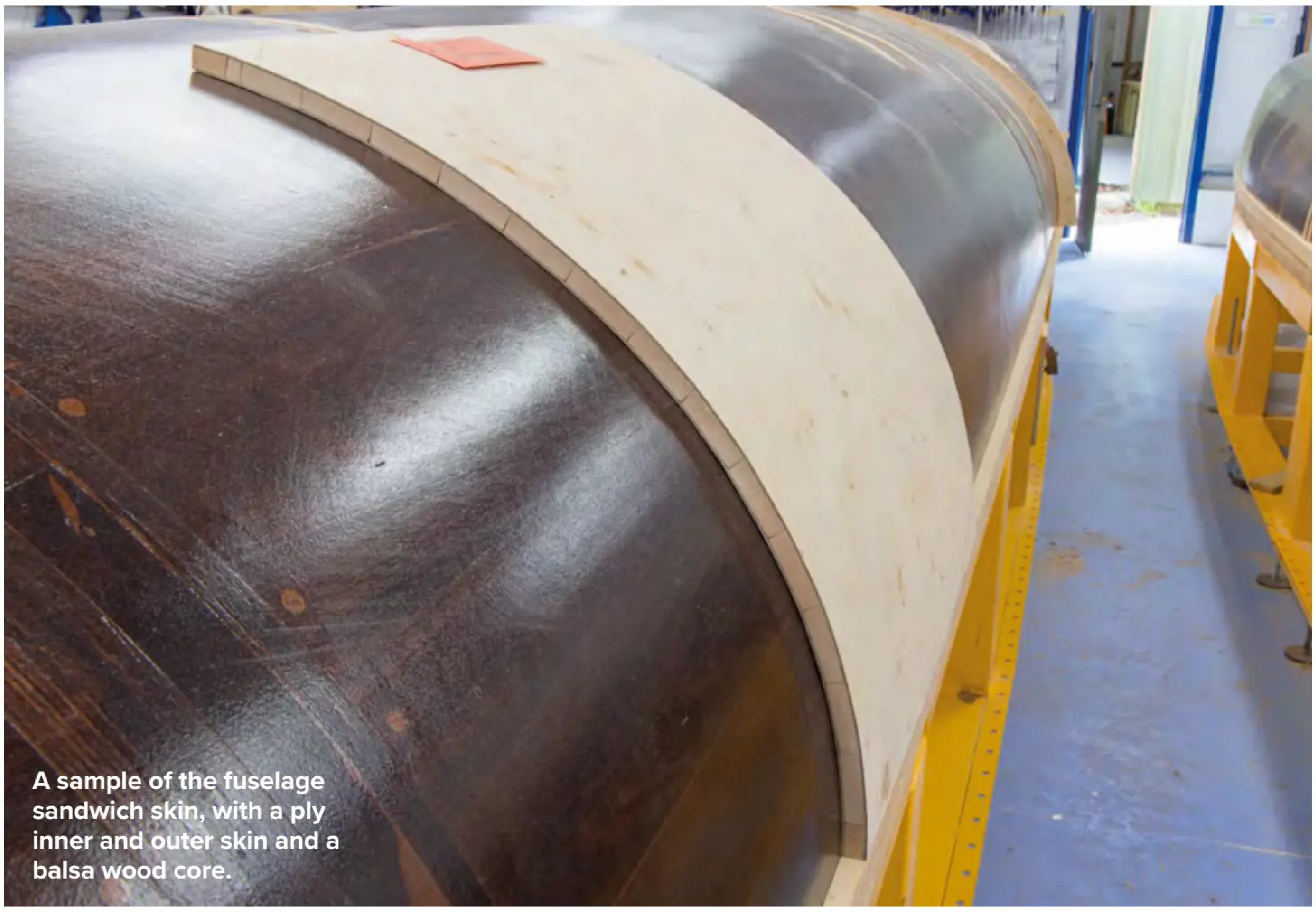
"We need the 45° plywood for the back of the aircraft because it's a torque tube. On the horizontal stabiliser and fin, when the elevator and rudder are operating you have high torque — twisting — loads in the fuselage. This 45° plywood moves and comes back, whereas the 90° would shear. It gives you radial strength. We've had to have this plywood manufactured ourselves, here, so we looked into how it was manufactured. The only way to make plywood is to use an adhesive called Tego film, and it's not a liquid glue but a dry sheet glue. It comes in a roll, is put in a press and heated. It's been necessary to do this to comply with CAA regulations and tested to a specific British Standard.

"So, the plywood for the back end we're making ourselves, but the plywood for the front is being sourced normally. You could do the 45° plywood by twisting a 90° sheet and cutting it, but you'd lose so much of the sheet because they only come in 50in square. You'd waste half a sheet every time. That's no good. We're making the particular sizes for what we need. And no-one outside the plywood trade in Finland has the glue, though we have now sourced a company there that will formulate and supply it to us."

In the Mosquito workshop, the newest of Retrotec's premises, is a bonded wood store, which naturally is temperature-controlled. All the spruce timber is kept in there until it's utilised: A-grade for the airframe's main structural



A sample of the fuselage sandwich skin, with a ply inner and outer skin and a balsa wood core.

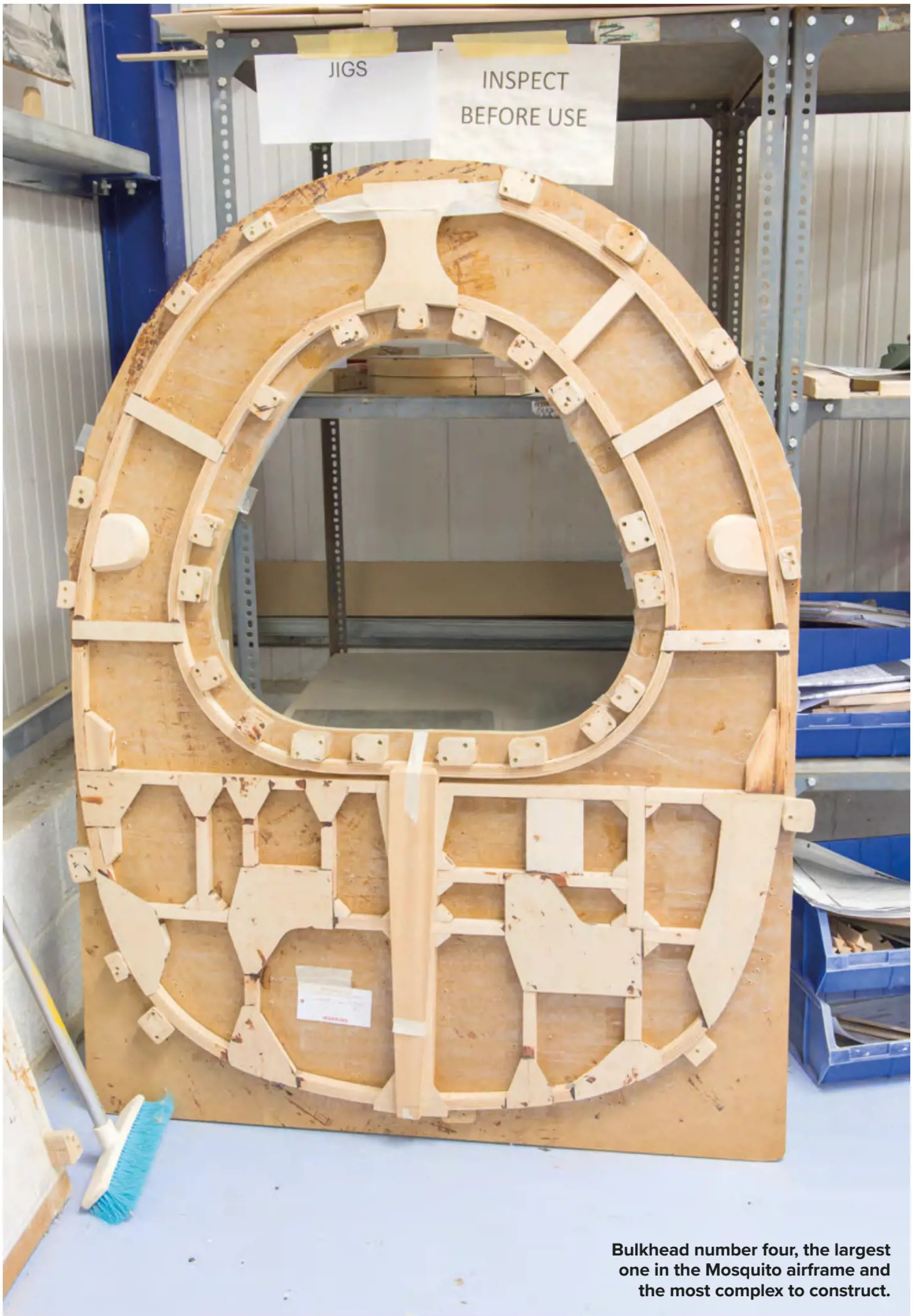
elements, B-grade for blocks and other smaller items. Black walnut is employed for hard blocks and the like. There should be enough balsa in there to complete all the in-fills for the two fuselage shells: 300 lengths of 3m-long pieces, 3in by 2in.

Also in the store are pieces of a very heavy compressed timber, the making of which involves lots of tiny veneers set in resin and put in a press. Often most associated with propeller manufacturing, it's used on the Mosquito for load-bearing blocks: as Paul Cole explains, this means "anything that's going to take a bolt, to stop it pulling through… It stops the bolt biting into the timber."

> ***"Any wood that's going to fly, we have to keep a record of"***

This unassuming room, full of wood, has an absolutely central role in getting the Mosquito airborne. "Each piece of timber has a code on it — even small pieces. The code is for CAA-compliant paperwork purposes. Anything we buy in that we're going to fly, we have to keep a record. It has to be traceable all the way back to the place where the tree was felled. The only mill we can find which does aircraft-grade timber is in the Netherlands, and it gets its wood from Canada. Its main business is tall ship masts.

"And with anything we glue, we have to keep glue samples. The samples must be a certain size: that's 4in by 0.5in by 1in. You make up a batch of glue, then glue your item together — whatever it is — and make two samples. The glueing surface can only be an inch long. You record all the details such as the glue you've used and the batch, because the glue's traceable as well. The next morning you break one of the samples, and if it breaks on the glue line you throw the component away. If it's a bulkhead, say, and the break is bad, you throw the whole thing away and start again. But if it's a timber failure, not a glue failure, that proves you've done it correctly."



Bulkhead number four, the largest one in the Mosquito airframe and the most complex to construct.

Elsewhere are other important items that will make the Mosquito whole. Retrotec has made an accurate pilot's seat entirely in-house; while TPM does have an original seat from a bomber aircraft which is quite different except for the seat back, and because the correct armoured steel plate is no longer available, it had to find an original. Guy Black says, "If we wanted to change the material, that would be an expensive modification as the seat is also the anchor points for the pilot's safety harness".

Likewise, an original door is in the project's possession, but it can't be used because that is a bespoke part and won't fit the new fuselage. The door skin needs to be cut to size to fit the particular airframe.

However, all the metal fittings from the original — one of the many instances of a good deal of metal being used in

The complex laminated wing beam for the wing attachment.

Mosquito manufacturing — will be used on the new one which will be cut when ready. And, at Retrotec's existing Westfield workshop, the instrument panels are completed and many other metal parts are in production.

It need hardly be said that, as with any return-to-flight or reproduction project, all this comes at a cost. From TPM's side, John Lilley reports, "To date we've raised more than £2 million of our target, which is £10 million, though that £10 million can be shortened if sponsors or other support come forward for big capital items such as engines. Currently we're probably raising round about £40,000-50,000 per month, but to move it more significantly forward we do need to see ourselves going up to three times that amount if we're going to see this aeroplane flying in a reasonable timeframe. That is the challenge."

Of that £2 million raised, the charity now has roughly £1.6 million in assets, including all the obvious items now with Retrotec, and what John calls, "probably the largest collection of drawings out there for the DH98". Pushing on to the next stage, a new campaign, 'Four Engineers for Four Months', is being launched to effectively double the number of engineers working on the project — and particularly the fuselage build — over that period.

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When considering precedents, thoughts inevitably turn to Vulcan to the Sky and the difficulties it faced over many years in raising funds to first get Vulcan XH558 flying, and then to keep it airworthy. John Lilley was given much useful guidance by its driving force, the late Dr Robert Pleming — "he said", recalls John, "our fundraising strategy had to be pinned not just on public donations and T-shirts. We view airshows as PR, connecting with the public, our supporters, and also trying to win new supporters. After paying the costs towards going to airshows and other events, that profit will never build the aeroplane. So, our strategy is a combination of corporate sponsorship, high-net worth individuals, grants or other forms of funding for supporting engineering or charities, and also merchandise sales and club memberships as well. The majority of bigger funds will come through sponsors."

The current main sponsor of TPM is Airbus, which came on board during March 2020. The aerospace giant has backed the restoration and operation of many historic aeroplanes in mainland Europe — not just its own Heritage Flight fleet, but others too — and now it's doing the same with a British one. A nice link comes from the fact that RL249, the Mosquito whose vestiges provided the starting-point, was built at de Havilland's Broughton factory near Chester in a hangar still used by Airbus as part of its wing manufacturing facility.

"They have supported us financially", says John Lilley, "and we are their chosen UK heritage project. What we've also got from that is exposure and introductions to the right people in lots of different companies within the supply chain. That brings a benefit you can't get in a cheque. We've also attracted people who don't want to give cash, but want to give materials. For example, between Hexcel and TS Resins we get all the Aerodux glue we need completely free. We've had discounts on woodworking machinery, preferred rates for wood supplies and things like that.

"And we have been searching for suitable engines, either

Packard Merlin 225s or Rolls-Royce Merlin 25s, which are the specification for an FBVI. We do have an agreement that somebody will provide those engines for us, though I can't say at this stage who that is. That will probably save us up to £1 million in terms of the acquisition and zero-timing them, which makes our task a lot easier as well."

Alas the present state of the economy is not a help when seeking public donations. "The general charity sector is about 15 per cent down, and speaking to a few people at the Duxford Battle of Britain Air Show, the cost of living has bitten. We see that having an effect. But our other strategies to develop more industry associations and sponsorships are going ahead, and we're seeing much bigger progress with them."

> ***"We're seeing progress with industry and sponsorships"***

An application has also just been made to the National Lottery Heritage Fund, not hitherto known for its support to airworthy aircraft projects, the Vulcan aside. John stresses this is a more limited affair, however: "a regional application for a much lower, six-figure sum". And, thanks to a specifically ring-fenced contribution from one of the charity's high-net worth supporters, TPM now employs a professional fundraising organisation for two days a week, which will make other grant applications and identify and target certain organisations and individuals.

What's more, there will be a benefit in educational terms, a stated pillar of TPM's aims. It's partnered with East Sussex College in Hastings, which offers a lot of woodworking training, to provide work experience towards qualifications. Under the requisite supervision, students will probably be involved in making the frame for the fuselage shell to sit in. Other opportunities will exist with sheet metal, welding and the like. Both Guy Black and John are very keen to use the chance to build skills and develop an interest in historic aeroplanes among new generations.

The bonded store containing all the different types of wood for the aeroplane.

All this requires time to bear fruit, as does the build itself. It's not possible to have all TPM's actual and potential supporters touring through the Retrotec workshop, so the steps forward can be hard to illustrate. The intention is for the aircraft, when it's flying, to be what John calls "a gift to the nation", highly accessible to everyone and based somewhere with that in mind. Applying that philosophy to this part of the project is significantly harder, but he acknowledges the need to do as much as possible towards that end.

"Very clearly, until there's the shape of a fuselage coming off those moulds, the public will be fickle", he says. "They need to know there's the shape of an aeroplane. But we're absolutely convinced that going to this next stage, taking on those four engineers for four months to get it made, will change that. We know that 'progress equals donation equals progress equals donation'. It's a virtuous circle."

As Guy Black puts it, "There are masses and masses of small parts, and it's very difficult to portray to the people who've donated to the charity, but you can't do the mould without it. When Paul lays the plywood onto it and sticks it to all these little bits he's been making — and major bits too, like the bulkheads — it'll suddenly come together after that... It's frustrating for us, frustrating for them, but we're really, really near that stage now."

In fact, the hope exists that by the end of the Mosquito's 85th anniversary year, one side of the fuselage might have been done, but of course it's impossible to be precise about a date. Even if it ends up going into 2026, the direction of travel is clearer than ever. And behind it is a truly fascinating engineering effort not seen in Britain since the last example rolled off the Broughton production line in 1950. To have got this far is impressive. Now it's time for the next push.

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AEROPLANE meets TONY AGAR

Mosquito NFII HJ711 speeds — as much as it can — along East Kirkby's turf, ex-BBMF Lancaster pilot Ed Straw at the helm. BEN DUNNELL

DARREN HARBAR

The preservation world has seen few stories more inspiringly splendid than that of one man and his beloved Mosquito — a labour of love that's lasted for decades

WORDS: BEN DUNNELL

To see de Havilland Mosquito NFII HJ711 in the flesh is quite something. To watch it running its two Merlins and taxiing ranks as utterly exceptional. Before it became active again, Britain hadn't had a live 'Mossie' for more than 20 years, a huge gap in our national aeronautical heritage, but one this aeroplane was destined eventually to fill. And the story of how it came to do so is, without a hint of hyperbole, among the true epics of aircraft preservation in this or any country.

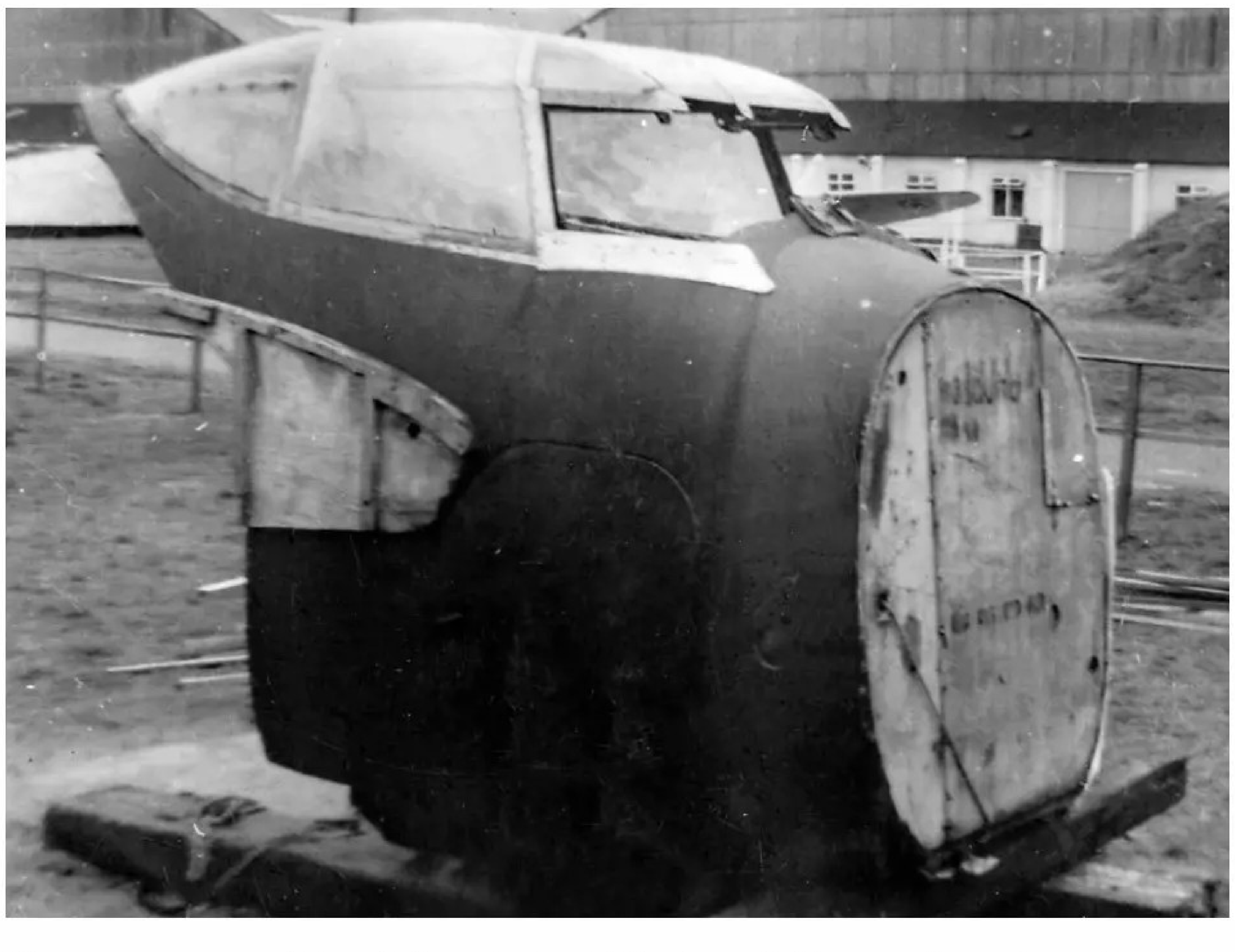
This Mosquito is the life's work and the pride and joy of one man, Tony Agar. It started from the smallest beginnings, making scale models and collecting parts here and there. The machine that now graces the Lincolnshire Aviation Heritage Centre at East Kirkby, but which Tony still owns, represents the very epitome of grass-roots restoration. But what beggars belief above all about HJ711 is the fact that this is not a rebuild of a single airframe. Tony reckons sections and parts, large and small, from somewhere in the region of 50 different Mosquitos have gone into it. The scope of his task — even aided by an enthusiastic array of supporters — is almost unimaginable, even before you consider he had to learn all the necessary skills as he went along.

We met at East Kirkby, where the ever-friendly, modest Tony was fettling his beloved charge on a weekday afternoon following taxi rides at the previous Saturday's airshow. Another famous resident, which enters the tale twice over, was performing engine runs outside as we chatted. Inevitably we could only scratch the surface of this inspiring saga, but the memories flowed thick and fast.

> *"I got to know where Mosquito parts were on the grapevine"*

Tony's interest dates back to when he was in the air cadets and went on a camp to RAF Marham. "There was a model club with a table full of models, and the 'Mossie' was in the middle. I don't know whether it was the shape or what it was, but that's what got me. I was 14 or 15 then. I also flew in a Chipmunk there — another de Havilland. Over the years I wanted to research it, but all I could do was look for photos and make models.

"In the late '60s I read something about a guy who was doing aircraft 'wreckology' near York, and it mentioned a Mosquito. It was in a pool of water, and he was standing there holding onto the propeller. I went to see him because I wanted to go to the crash sites. The first



The anonymous 'Mossie' cockpit at Blackpool Airport, thought to be HJ711 but almost certainly not. VIA TONY AGAR

one I went on was at Bransdale, where a 'Highball' Mosquito was [BIV DZ543]… There were bits and pieces laying around on the ground, and I picked up a few parts. The unique one was the bracket to hold the sight, though I didn't know it at the time. I got hooked. They were my first pieces of 'Mossie'."

The pieces he recovered from the aircraft's 'Highball' weapon-carrier were too far-gone for use in what was to follow, but they have nonetheless been preserved. At the de Havilland Aircraft Museum at Salisbury Hall they have been incorporated into a display featuring a dummy representation of this smaller 'bouncing bomb', one of which DZ543 was carrying when it crashed on the North York Moors on 11 October 1944.

"I got to know where parts were on the grapevine", says Tony. Some of that was down to his membership of a preservation group in York. Finding out in 1971 about a wing and undercarriage assembly which had been used for civil defence crash rescue training at the Royal Ordnance Factory in Chorley, he arranged a visit. Mosquito XVI PF498 was the aeroplane in question, and the section was duly recovered.

Then a holiday changed things again. "What really started it off was when I

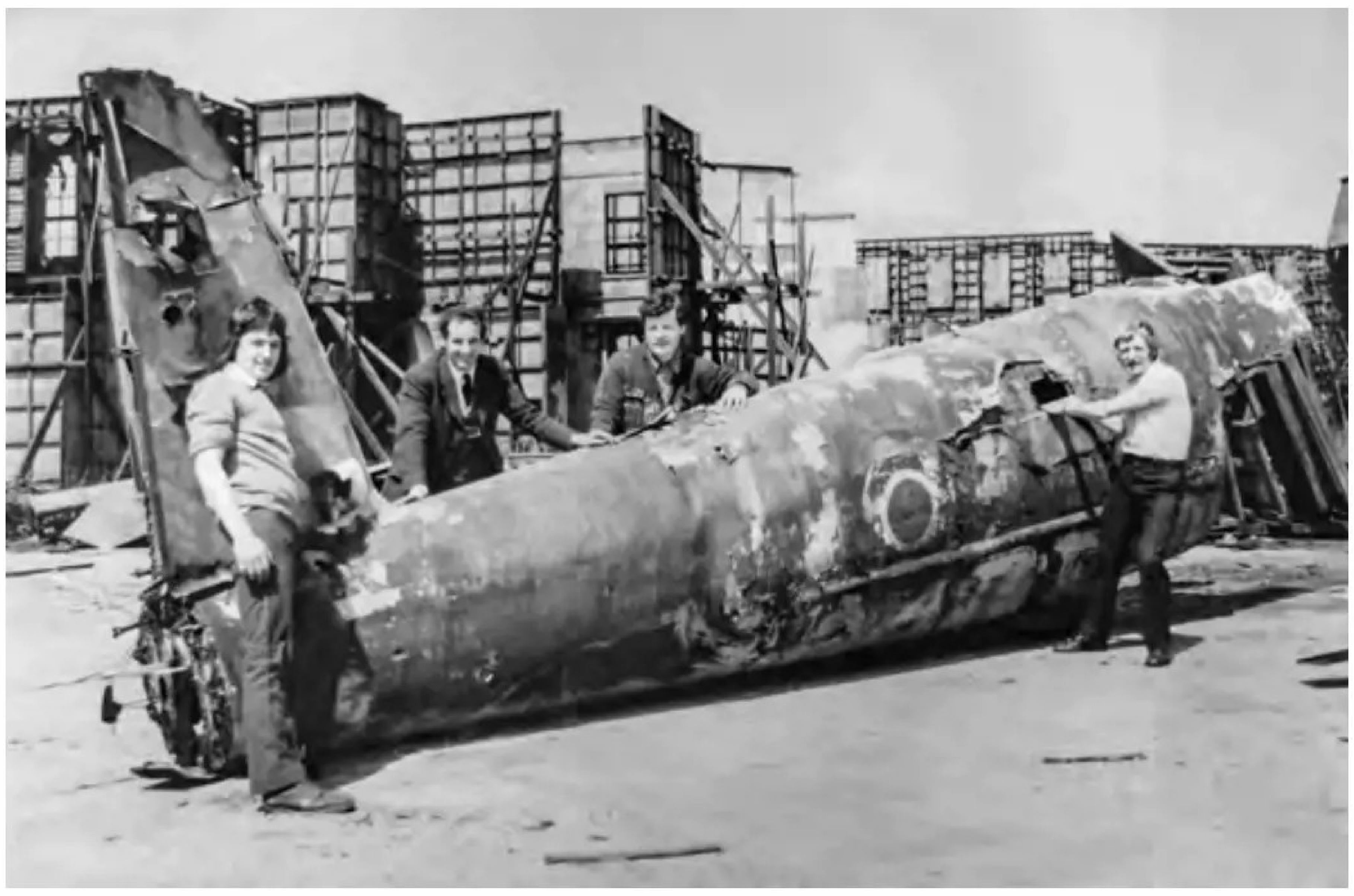
RIGHT TOP TO BOTTOM: Tony with his first major acquisition safely delivered to his home near York.

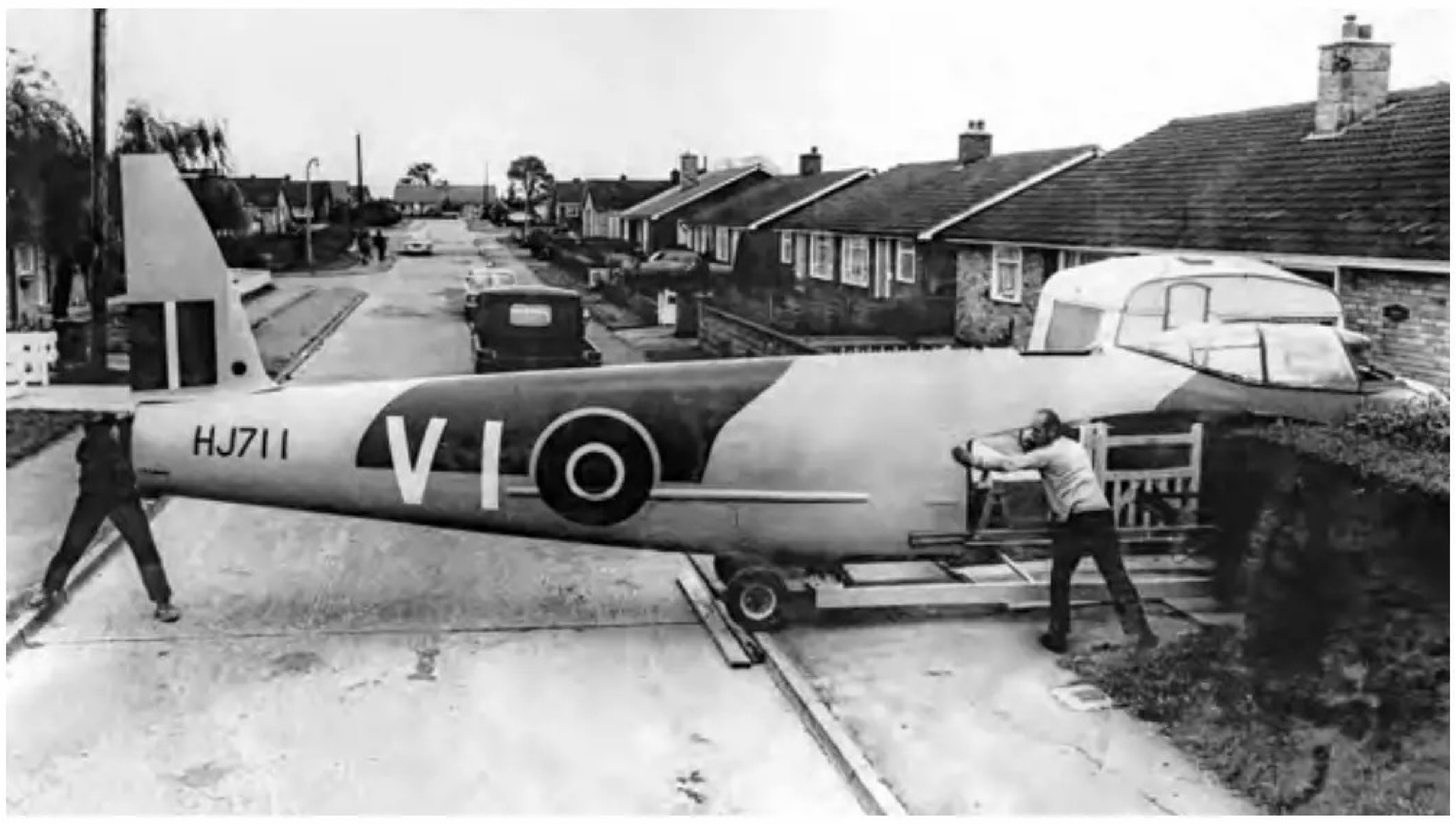
A breakthrough: the fuselage of Mosquito TT35 RS712 being moved from the MGM studios at Borehamwood.

Not many suburban bungalows have ever boasted their own Mosquito.

Ready for a first outing of the near-completed fuselage to Elvington in 1975.

ALL VIA TONY AGAR





was at Pontins holiday camp in Blackpool. I got 'half-day release' and went round to the Reflectaire museum at the airport. There was a 'Mossie' cockpit, just sitting at the side… I kept popping in to keep an eye on it and I got in touch with the directors, who said they weren't selling it. Eventually, of course, it was auctioned [on 29 April 1972]. £7 it was. The auctioneer said '£5', somebody said '£6', I said '£7' and no more came in, so I got it. There were other items thrown in with it.

"Prior to that being auctioned, some rudder pedals came up. I wanted to keep all my money for the cockpit, so I didn't bid for them. When the auction finished I was paying my bill, and I asked who'd purchased the rudder pedals. Whatever didn't sell went onto the next lot, and that had happened with them. I waited in the office, as it were, to get the nod… I approached this guy: 'I understand you bought the rudder pedals'. 'Did I?' I asked him how much he'd paid, and it was £1, so I gave him £2. I got the rudder pedals."

> *"I saw the cockpit frame coming past my privet hedge"*

What a significant occasion that was for British aircraft preservation. Included in the sell-off of the collapsed Reflectaire collection was, of course, its flagship, Lancaster VII NX611. While it failed to reach its £20,000 reserve, Lord Lilford paid £12,500 for the aeroplane a couple of days later, thus securing its preservation. Who would have believed the Mosquito cockpit and the Lancaster would be reunited many years later?

Long before that, though, Tony needed to get his purchases home. "In the group there were a couple of lads from RAF Linton-on-Ouse. Their little interest was transporting aircraft with Land Rovers. I don't think the CO was very impressed! Anyway, I was at home in my bungalow at Huntington, north of York, looking out of the window. There was a privet hedge, and I saw this cockpit frame coming past it.

LEFT:
Trusty Land Rover tows Merlin 25, slightly precariously.
VIA TONY AGAR

They'd been to collect it without me knowing."

But which airframe was the cockpit from? "In the auction brochure they mentioned it was HJ711, which had been with No 169 Squadron. That's all I had — I was just an enthusiastic novice". Said serial belonged to a Mosquito NFII night fighter, which was shot down on 16 March 1944 near Eupen, Belgium, while supporting a Bomber Command raid to Stuttgart. Royal Canadian Air Force pilot Flt Lt William Foster became a prisoner of war, while RAF Volunteer Reserve navigator Fg Off Jack Grantham lost his life. However, in every respect the cockpit's configuration was that of an FBVI fighter-bomber, not an NFII. With the blessing of No 169 Squadron veterans, Tony nevertheless decided to keep HJ711 as the aeroplane's identity, and so it has remained, although he'd rather have liked it to represent a wartime BOAC 'Mossie'.

Starting work on the nose, "there was no fabric. It was covered in a black paint. It took me ages to remove it, but it had preserved it. I kept it outside for a while until I got my garage sorted out. Then it went in there. It gave me time to clean it up and get to know it. There was very little left in the nose — down in one corner there was part of a control for the ailerons. I took the armour plating off to work on it, and it was heavy."

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This was where things began to snowball. "The father of a lad in the group owned a big transport company in Leeds, and he mentioned a wing in south Wales. First I went to the wrong airfield: I went to Brawdy, which was nearby. But he gave me another fix, so down I went again, and this time I found it at St David's. I was in a little 'Frogeye' Sprite, and it was a day's driving time. The wing was in a dump area. It was only the port one that was salvageable; the centre section and the rest of it had been burnt."

The aircraft involved was a Fleet Air Arm Mosquito TIII, VA878, victim of a 1956 take-off accident. Before it could further deteriorate, Tony and his brother

BELOW:
Arriving at the Yorkshire Air Museum during 1986, still with a lot to do. VIA TONY AGAR

RIGHT: Tackling the wing structure, in Elvington's welcome but cramped working space. VIA TONY AGAR

travelled back to recover it. "We went in a works pick-up, and we were stopped by the police at two o'clock in the morning: 'What are you doing in Wales at this time of night?' It was full of water, so it was heavy, and we had to cut part of the centre-section away, which took ages to saw through. It was the only way I could do it. In fact I brought that back with me as well."

The Mosquito wasn't all he found. "When I went to St David's for the first time to recover it with another team from Linton-on-Ouse, we couldn't do it. But there were some Hornet fuselages at St David's, eight of them — just the rear portions, some shorter, some longer. Because I couldn't get the 'Mossie' wing that time I brought two of them back so we weren't going home empty. I kept the best one in my garage. The other one went to a group which broke it up". The portion of Sea Hornet NF21 VX250 which Tony saved is the largest surviving piece of the type, and it's in the de Havilland Aircraft Museum.

> ***"I walked down this road and the fuselage was an amazing sight"***

Not far around the corner was Tony's biggest Mosquito prize yet. The fact of the fuselage from TT35 RS715 having been dumped at MGM's British Studios in Borehamwood after use in ground scenes for *633 Squadron* was, he says, "well-known — not to me but to other people. Nobody was interested. We tried to find out where it was… I couldn't get any information, so I went down there in my Singer Vogue. One of the studios was all active: 'Oh, no, you can't come in here…' But there was another site, which was empty and derelict. I wasn't allowed in, but when I went round the back I always say there was a gap in the fence. I walked down this road and it was an amazing sight.

"I didn't know who to contact, but I called the Mosquito Museum" — as the Salisbury Hall museum was known at the time — "and Stuart Howe knew… Stuart got in touch with Eddie Reynolds, who owned it, and a week later I was

RIGHT: An initial mating of fuselage and wings. VIA TONY AGAR

LEFT: HJ711 and RR299 on the Elvington apron together for 1991's special occasion. Peter Henley had flown the BAe aeroplane in.
VIA TONY AGAR

down there picking it up. I put it on a car transporter. Back then I was hopeless at tying things down, and I was putting ropes here, there and everywhere. It looked like rigging on a ship."

At this stage Tony had no particular plan for all his finds, but they kept coming, and gradually evolved into a restoration. In many cases it proved to be the last chance to acquire these items. A major boost came from a store in Kidderminster, which held boxed Mosquito spares in quantity. Luckily he got what he wanted before the owner died. Yet more was to be discovered in a warehouse near Auchterarder, such as bomb doors, torque tubes running from the main spar to the engines, and "very rare" side panels. Tony and his brother were about to leave when they saw a Perspex nose. "I couldn't go without that, so I paid £8 for it. The only space I had was in the passenger seat of the Singer Vogue, so I put it there and my brother Robin was sat in it all the way from Auchterarder."

When the prospect of some engines presented itself, Tony was off to the Empress Works in Wigan. "Dennis Kay had bought two two-stage, two-speed Merlins, a 76 and 77. They came off NT616 [a Mk30 scrapped at Cosford]. They were in a bad state and they were the wrong engines, but I wanted them for the project because they were the only ones I had any chance of at the price. I borrowed and saved and I paid nearly £800. One still had a propeller blade on.

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"I went to Dennis Kay's private property, a large house, and there were Merlins there… Outside there was this cover. I looked underneath and I couldn't believe my eyes. A Merlin 25, and it had everything on it. He said he wasn't selling it. Anyway, he must have needed some money for something. He 'phoned me up on a Sunday morning and said, 'Right, Tony, if you want that engine it's £1,800 and you've got two weeks.' I got it. Another guy, Peter Woods, who lived in Twyford, was into Merlins and he had a basic Merlin 25. He called and asked if I was selling the two-stage engines, because he wanted both of them on display. It was a two-way deal and I was able to get his engine to go with the other one."

Having worked as a labourer for Rowntree, Tony moved to become a storeman at an engineering works, then a polisher and sprayer before starting as a metalworker. The latter trade came in handy when tackling the metal parts of the Mosquito, of which there are plenty. He found some which proved usable in unpromising circumstances. Copper tubing for the coolant came out of a "stinking" pit at Little Snoring, as did a stainless steel firewall for the port engine. One for the starboard side was located not far away at Langham.

A garage extension at his bungalow made more space for the cockpit and fuselage in particular. As early as 1975 they were brought together and partly painted for transportation to Elvington for a gliding club event. "I wish I hadn't, actually", reflects Tony, "as I was putting it at risk". And putting them together was one of the most difficult moments of the project. "It was a matter of trimming back the cockpit and then grafting back in again."

Given how those sections looked before Tony restored them, their level of originality may surprise, even on a non-airworthy aeroplane. "I had to splice it in one place and put a new shell area in there. But apart from local areas where there was damage, it's the original wood. There were quite a lot of ferrule holes, so I filled them in with balsa and put a new skin on the inside, so it was capped. I'm amazed that nothing's moved. I went round it the other day on the inside with a torch, checking all the joints, and nothing had moved. I made sure I did a good job."

Moving the project to the Yorkshire Air Museum at Elvington in 1986 was transformative for its fortunes, for there was far more

ABOVE: There were opportunities while at Elvington to see HJ711 by night.
ALAMY

space there than Tony could ever have created by extending his home garage. "I knew one or two guys there, one in particular, and they put the word round. I had access to the building, and of course in the earlier years they weren't opening all year round, so I had the winter-time all to myself when I built the wing. That was a *big* job."

Using the sections recovered from Chorley and St David's years earlier, he set to work. "I was lucky that the wings I'd got were so bad the only salvageable pieces were the spars and the ribs. I had to go right down to the spars and come forward". This required a lot of wood, and there Tony's good friend Karl Kjarsgaard, director of the Bomber Command Museum of Canada, proved his worth.

"He was the biggest scrounger in the world, and he could come up with the backing. Karl's father knew the director of Weldwood, a big timber company. They had a depot at Purfleet, just off the M25, and they donated 40 lengths — it was going to be 20 Sitka spruce, 20 Douglas fir, but we worked out we needed more spruce, so were given 30 lengths of Sitka spruce and 10 of Douglas fir. I used that timber to go into the wing and the stringers. They were machined by a joiner just round the corner from where I lived, and he did it all for nothing. I did all the splices, and I got quite good at it."

All the way along, those contacts at home and abroad have come up with the goods. Australia, Canada — where Tony aided the Windsor Mosquito Bomber Group's team restoring B35 TA661 — and New Zealand yielded a great deal. Closer to home, "I bought two wingtips from someone in Livingstone. They were for sale in *Exchange & Mart* for £5 each… When Doug Arnold had trouble with the wingtips on his Mosquito [TT35 RS709, traded to the US Air Force Museum and ferried across the Atlantic in 1984-85] I said I had a pair, so we swapped them. He gave me a tailcone, because he made them out of fibreglass."

> ***"Going to East Kirkby would allow us to get the engines running"***

A tip-off took Tony to Glen Esk in the Highlands, where BOAC Mosquito VI G-AGGF had come down on 17 August 1943. "It was *wet* up there. Luckily we got in touch with the ranger, and he took us up this path in his new Land Rover. We passed a Halifax wing, I think it was. We got to the site, and there were about three positions of it. There was quite a lot there, and we loaded what we could". The rear portion of HJ711's starboard nacelle comes from the G-AGGF wreckage.

Very friendly contact with the British Aerospace team at Hawarden operating Mosquito TIII RR299 paid further dividends. "Whenever I asked for any drawings, I got extras. I know you shouldn't get them, but when there were particular cases they turned a blind eye. I got quite a lot of drawings, which was tremendous, particularly with the wing."

On its wheels and with a partially completed wing, HJ711 was rolled out on 15 May 1991 for a unique commemoration. It was 50 years since the prototype Mosquito night fighter had flown for the first time, and BAe brought RR299 to Elvington for a two-'Mossie' tribute. "For them to do that was just unbelievable. It was a horrible day: cold, wet, windy. It was on the limit, but they landed it."

As the 1990s progressed HJ711 became complete, but it went on being constantly improved when additional parts and resources allowed. Using his family's bath for experimentation purposes, Tony had earlier taught himself how to dope the airframe. Doing the fabric work proved to be a particular pleasure, which was just as well when he decided to re-dope it in 2006. "I put the wrong paint on in the early years", he recalls, "not knowing, so the old covering was cracking up. I had to strip it all off and start again."

The aim of ground-running was much in mind. "Going back to Canada, they had two Merlins off a crashed 'Mossie' [a B35] in Pelly

LEFT: **Running the port engine during 2018, the first season of 'live' activity at East Kirkby.** DARREN HARBAR

Lake in the Arctic Circle… I needed induction manifolds for mine, and I asked if we could exchange my starboard top end for their top end, which we did. When I was on one of our visits to Oshawa there was an aircraft store, and in it, near a broom cupboard, were six propeller blades. The paddle blades I had and the top end of my engine went into a container with some bulkheads recovered from a gravel pit at South Cerney, because they were Canadian. On the return they put the propellers out of that Oshawa store and their top end into another container and Karl, who was a pilot for Air Canada, had them flown over. I went down to Heathrow with a lad in his van who did the driving for nothing. All I had to pay was the duty, which was not much. It would have cost thousands! That was Karl.

"The spinners came from New Brunswick. There was a guy looking for car spares at a garage, and there happened to be a pair of spinners there. He said he happened to know somebody who might need spinners, and explained who I was. The owner said he could have them. They were taken from New Brunswick down to Toronto, and it was Karl again who got them here with his 'techniques'.

"Over about five years […] I put the pneumatics in for the brakes, all new material. With the help of some electricians, we did all the wiring". New fuel tanks for the wings were fabricated too. But engine runs were never destined to happen at Elvington, and Tony felt the Mosquito deserved greater prominence than it was getting there. In 2017, he recounts, "it came to a crunch with politics", and he took the decision to move the aeroplane to East Kirkby.

"It was Andrew Panton [the Lincolnshire Aviation Heritage Centre's general manager] who contacted me", Tony recalls, "and gave me the 'phone numbers of some of his contacts for doing items on the aeroplane. So he was giving me encouragement and support that way. Then I thought, 'We've had enough — we'll go', because it would give us a chance to get the engines running and everything else. It's a different world now. All that work I did for five years at Elvington was, indeed, the preparation for the relocation to East Kirkby."

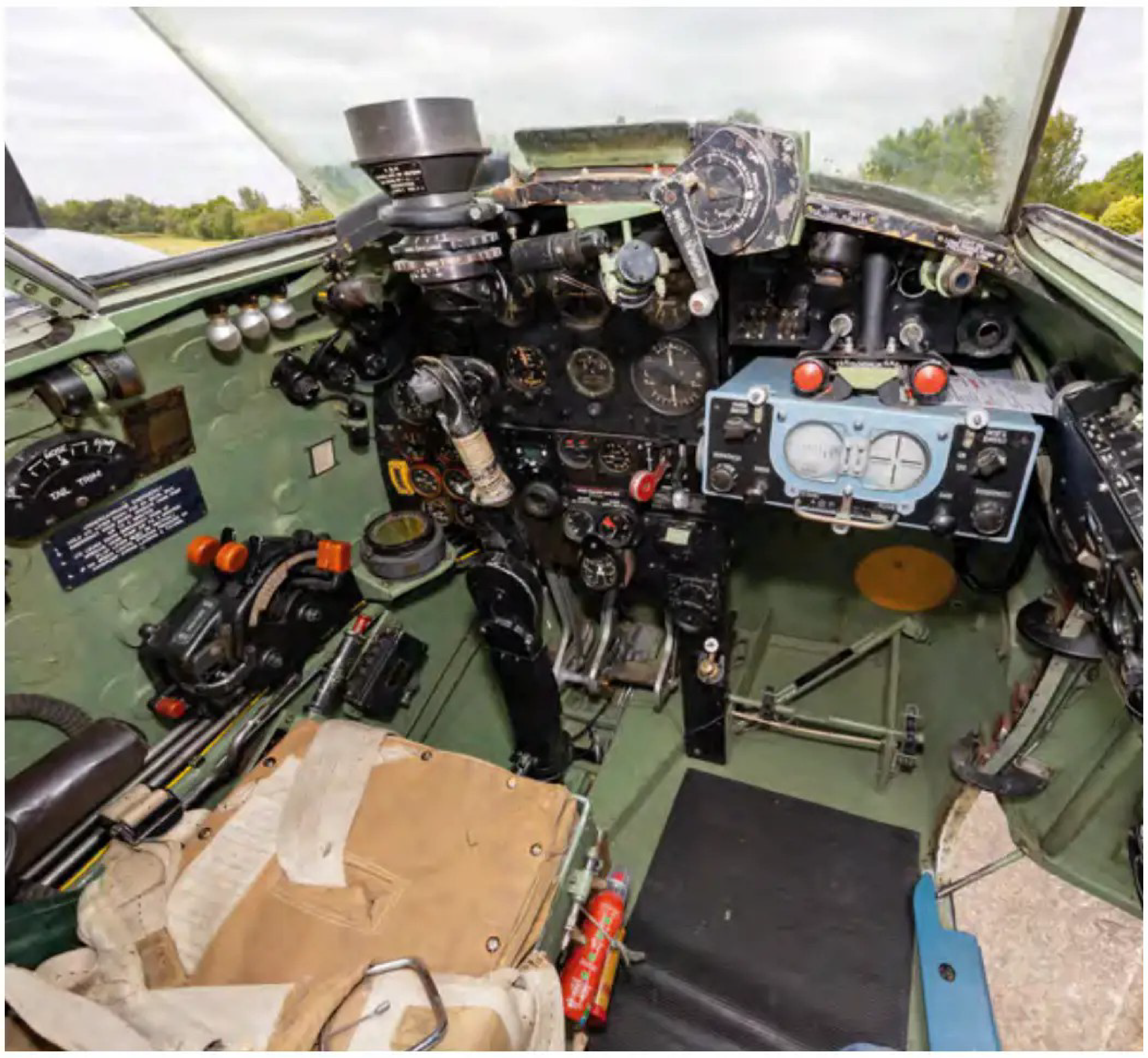
The Mosquito's move having been completed at the end of July 2017, attention turned to the Merlins, the LAHC chief engineer Keith Brenchley heading it up. "There was a lot of work needed doing to them. With the port one there were problems, but they were overcome. The starboard one needed a complete rebuild — there's three engines in there". A first, private run of the port engine only was followed by one in

LEFT: **With engineer Martin Lawton, removing the trolley acc.** DARREN HARBAR public on 30 September 2018, which Tony looks back on with understandable pride. "From being stuck under that tarpaulin near Wigan to running on an aeroplane. Oh my word! What a journey."

It continued with a maiden public taxi run, both Merlins in full song, on 6 May 2019. That August's East Kirkby Airshow saw another milestone: the first joint taxi demonstration with Lancaster NX611 *Just Jane*, for which Andrew Panton was delighted to be at the helm of the 'Mossie'. Not for at least 23 years, since the tragic loss of Mosquito RR299 at Barton in July 1996, had examples of the two illustrious types last moved together under their own power on a British aerodrome. Such is the potency and uniqueness of HJ711.

Tony has never taxied HJ711, because he feels his flight years ago in the ill-fated RR299 cannot be beaten. He points out, "People ask me why, and I say I don't want to. I've flown in a Mosquito". BAe test pilot Tony Craig took him on a sortie from Hawarden over to Anglesey and back, one that lives long in the memory. But he's delighted the experience of riding in his aeroplane on terra firma can now be shared with others.

In a similar vein, many individual aircraft, units and crews are honoured through this airframe. But the significance of Tony's work goes far beyond HJ711. He's exchanged information and countless parts with Mosquito owners, operators and restorers the world over, and they in turn have helped him. The very essence, in short, of what's best about the preservation movement.



RIGHT: The exceptional cockpit fit-out, with items gathered from countless Mosquitos and, in some cases, other aircraft. Shavings from donor airframes are kept in the cartridge containers, so as many of them as possible have a tangible presence. DARREN HARBAR

One charming anecdote from the project's formative period is nice to relate as a reflection of how far things have come. "When I was in stores where I used to work", says Tony, "and I was in an area where there was nobody about, I'd mark an area 27ft wide on the floor and try to get the chord of the wing, so I could visualise the size and volume and have some idea of what I was going to pick up. I thought, 'Bloomin' heck, that's big'". Now he can cast his eyes over the whole thing, the product of decades-long dedication.

Sparing Tony's blushes, and — as he always does — acknowledging those who have helped, this magnificent aeroplane simply wouldn't exist without him. "I don't know how I did it", he reflects. "I honestly can't believe it. I look at all the photos and think, 'Where did I get that from?' My late wife Val once said, 'It's destined to be', and it was. Incredible. It's been a tremendous journey."

RIGHT: HJ711 leads its East Kirkby stablemate, Lancaster NX611, on a joint perambulation around the airfield. BEN DUNNELL

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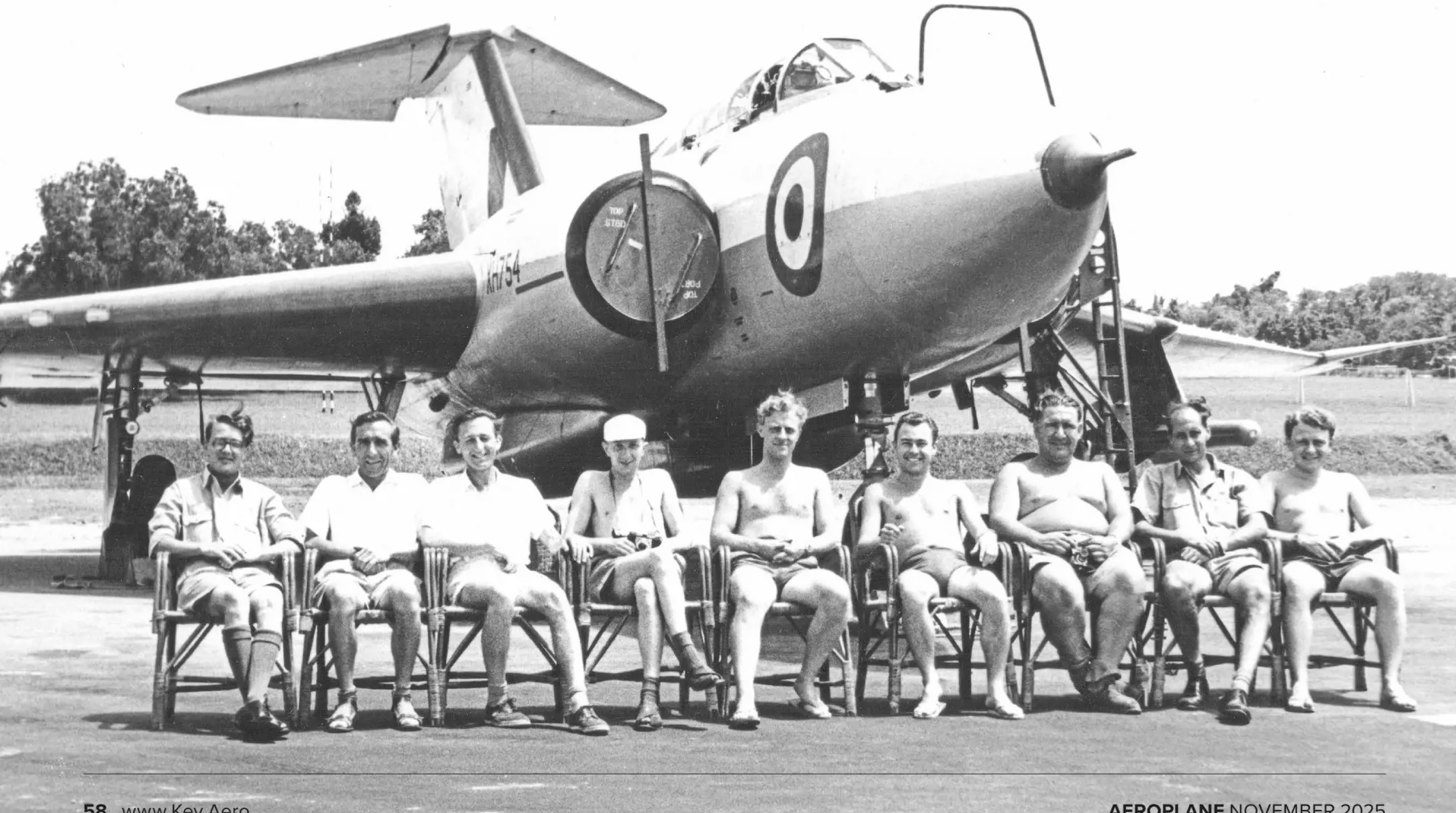
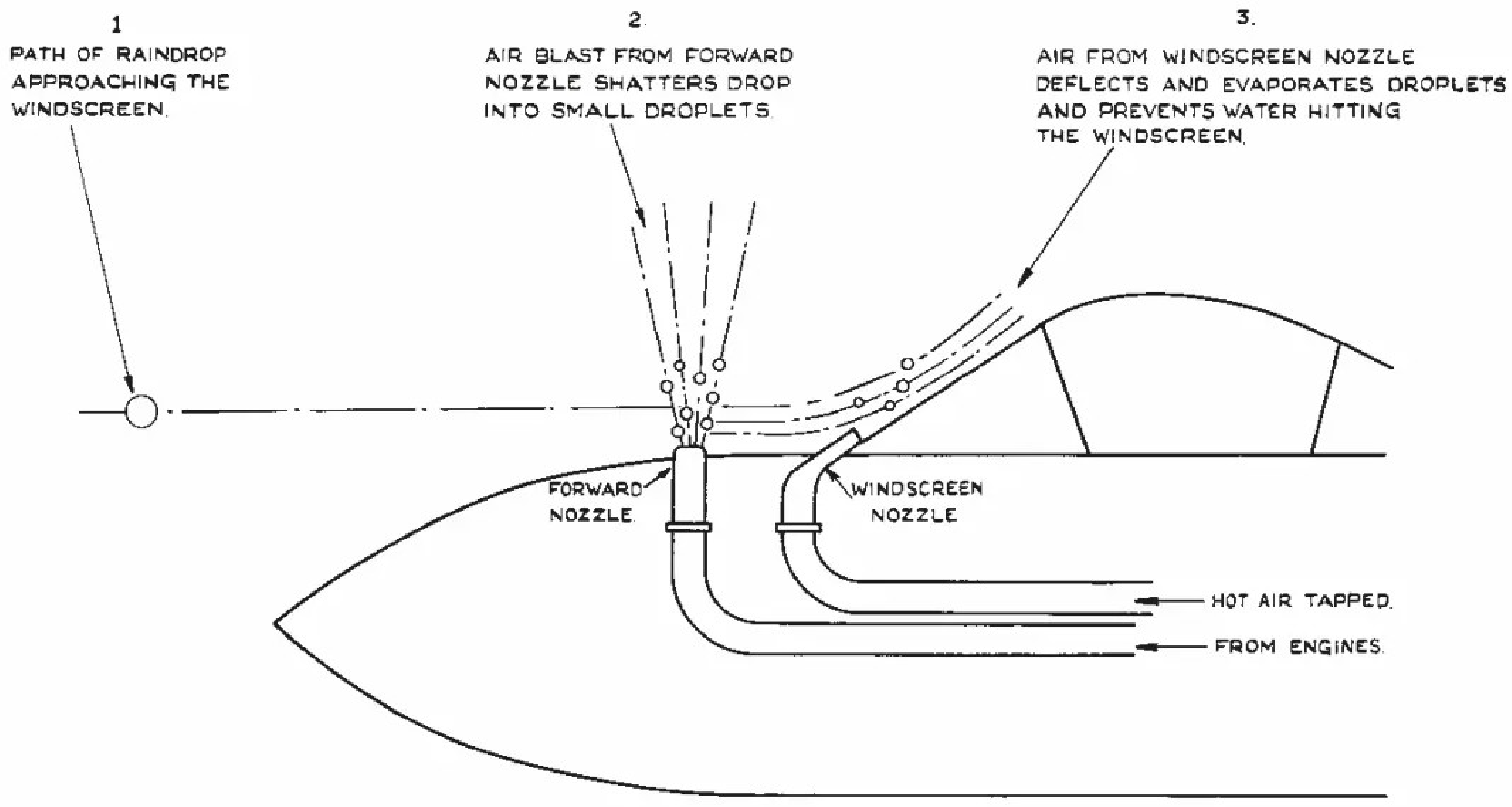
RAIN, RAIN, GO AWAY...

In testing the rain clearance system for the TSR2's windscreen, the Royal Aircraft Establishment turned to a Gloster Javelin as its testbed — and a long-distance trials deployment ensued

WORDS: NICK WATERS



The RAE trials team with the Javelin, Dr Waters being seated far left.
M. H. L. WATERS COLLECTION



LEFT:
A diagram of the rain clearance principle as applied to the Javelin testbed.
CROWN COPYRIGHT

The British Aircraft Corporation's TSR2 programme is remembered for many things: producing an elegant technically advanced aircraft, being used as the means of consolidating the British aviation industry, and becoming highly political and controversially cancelled. I have a much simpler recollection, which is that it was the reason for my father going to Singapore in 1961. At the tender age of two-and-a-half, this made quite an impression.

He was a scientific civil servant with the Royal Aircraft Establishment at Farnborough. After his death in 2017 I came across his preliminary report and photos from his work on the rain clearance trials to support the TSR2. They shed an interesting light on how flight research was carried out in the early 1960s and the depth of work needed to support such an advanced programme.

The specification for the aircraft that became the TSR2 provided many technical challenges. Operational requirement OR343 stipulated, "Roles of the Aircraft: To deliver effectively tactical nuclear weapons from low altitudes at the maximum ranges obtainable and with minimum consideration for the prevailing weather conditions, by day and night". It specified many attributes in more detail, including, "Windscreen and Transparencies: The rain removal system should be capable of clearing an area sufficient to give adequate view for approach and landing in heavy rain, and to see straight ahead in cruising flight in moderate rain" and, "A blast air/aerodynamic system is required."

In his excellent book *TSR2: Britain's Lost Bomber*, Damien Burke says, "The Lightning had an efficient rain dispersal device at the front edge of the windscreen, which blasted air upwards to shatter or deflect droplets, but this was only thought to be effective up to 350kts, not the 750kts being aimed for with the TSR2". To support BAC in meeting this challenge, the RAE investigated a number of solutions, which culminated in the tropical rain trials flown from RAF Changi in Singapore.

The principle chosen for the rain clearance system was to blast high-pressure air up in front of the aircraft windscreen to break up large rain droplets, with a second nozzle directing air parallel with the windscreen to prevent water hitting it. A Gloster Javelin FAW7, XH754, was selected as the test vehicle, based on availability at the RAE and the aircraft's performance.

The report on the trials does not discuss the design process for the various configurations of nozzle, but notes, "The aircraft was initially tested in the RAE blower tunnel for simulated rain trials to determine the most promising configurations and eliminate others. After this winnowing process twenty-two combinations of forward and windscreen nozzles remained to be tested."

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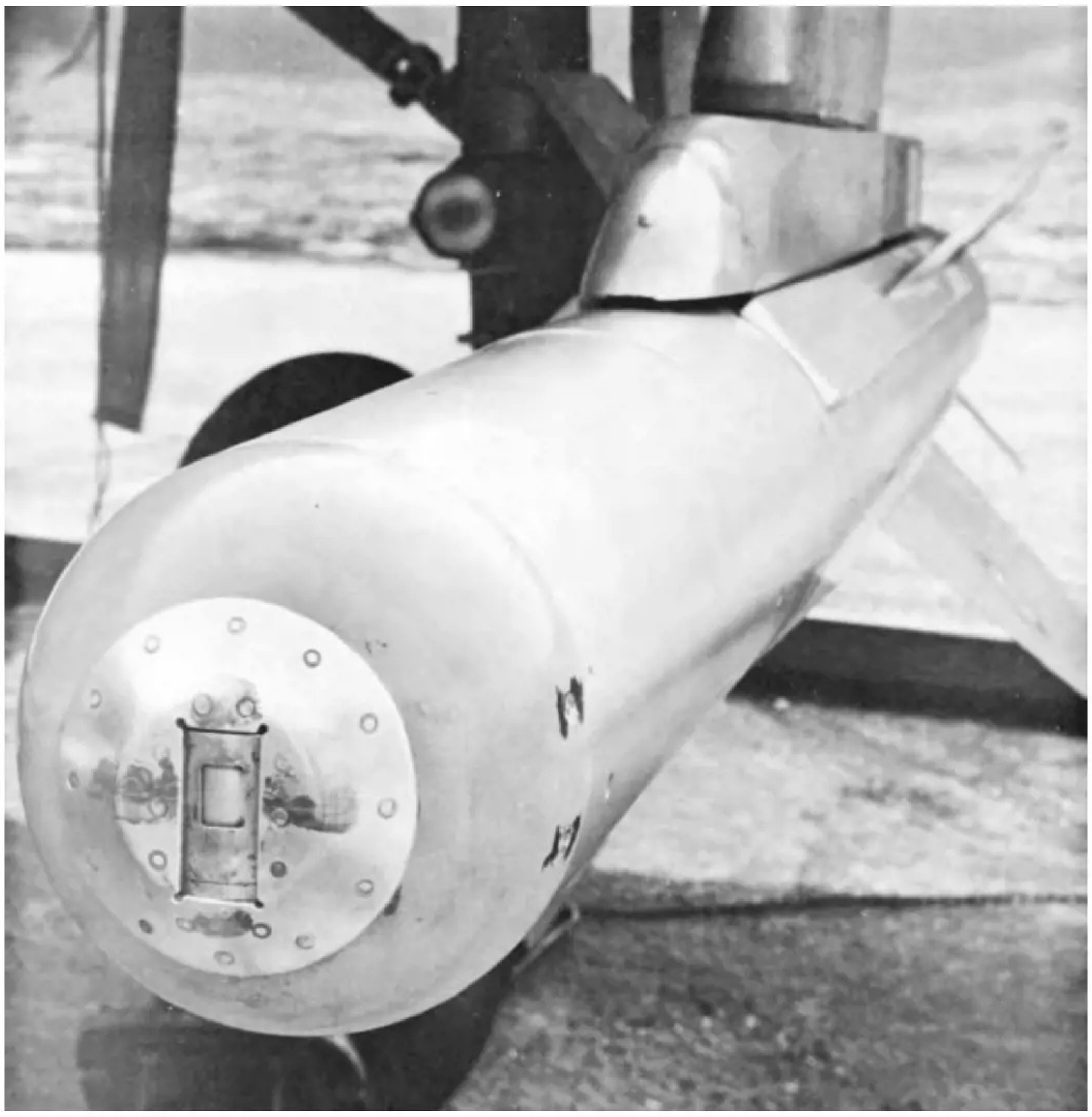
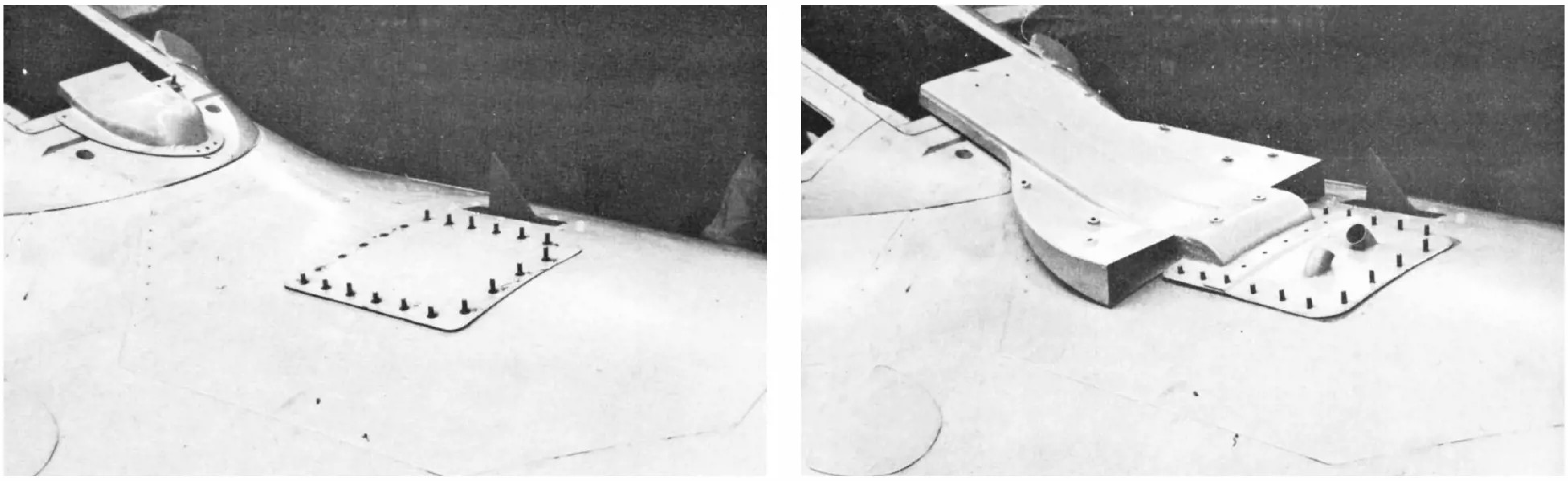
The system installed in the Javelin used air bled from the starboard engine compressor for the forward nozzles and from the port engine for the windscreen nozzles. The air mass-flow bled from each Armstrong Siddeley Sapphire powerplant was controlled independently from the navigator's rear cockpit.

To compare the effectiveness of the rain clearance nozzles they wanted to measure the rain intensity. An aluminium foil rain recorder with a 6in hemispherical nose was fitted into a dummy Firestreak air-to-air missile and mounted under the port wing. The pilot would start the recording so foil moving past the drum was exposed to rain for a fixed time



LEFT:
The foil rain recorder in the nose of the Firestreak missile. The foil was only 0.002in thick.
CROWN COPYRIGHT



Recommended windscreen nozzle W1, here without a forward air blast nozzle fitted, and forward air blast nozzle F1, with a different windscreen nozzle, W3. The report did not include a photo of the preferred combination as used for the TSR2. CROWN COPYRIGHT

during each sequence. Half-second timing marks were applied to the foil while it was recording. The foil selected was 0.002in thick to avoid tearing at higher speeds, though this meant droplets smaller than 0.5mm in diameter would not be recorded.

In preparation for the trial there was concern about damage to the aircraft when flying through heavy rain at high speeds. To minimise this, a polyurethane coating was applied to the leading edges of the wings and empennage and to the foil recorder and its pylon. The report says this was the first trial in which an aeroplane had been treated in this way.

A study identified the best place to carry out the trials. The UK was rejected as a cloudbase of 1,000ft was required for safety, and the combination of this with heavy rain only occurred for a few days during July and August. In Singapore there was heavy rain from a sufficiently high cloudbase almost every day, which presumably justified the considerable expense of locating the trials there.

The party consisted of my father, Dr M. H. L. Waters, and Mr L. J. Warren from the mechanical engineering department at the RAE, together with senior supervisor Mr E. Haslett and four colleagues from the Experimental Aircraft Servicing Department. The Javelin pilot for the initial phase was Flt Lt Darrol Stinton with navigator Flt Lt F. T. West. Stinton went on to join the Air Registration Board and was a founding member of the Historic Aircraft Association.

Leaving Farnborough on 15 March 1961, the Javelin was supported by Handley Page Hastings TG506 captained by Flt Lt Goodhew. The route to Singapore was via France, Malta, Greece, Cyprus, Turkey, Iran, Trucial Oman, Pakistan, India, Burma and Malaya. Such frequent stops were necessary due to the Javelin's relatively short range. While the Hastings arrived at Changi on 22 March, the Javelin was delayed at the Royal Australian Air Force station at Butterworth by a fuel booster pump failure. It arrived on 30 March and the flight trials started the next day.

Test flights were usually made through isolated showers of one to five miles in horizontal extent. This type of shower was prevalent in the Singapore area during the afternoon. Rain intensities of at least 2in per hour and up to a maximum of 7in per hour were experienced. By way of reference, very heavy rain in the UK is considered to be 2in per day.

A typical flight enabled all the air mass flow and speed variations of a particular windscreen and forward nozzle configuration to be examined. Once a suitable shower was found, the navigator controlled the nozzle mass flows to the first required value and the aircraft was flown through the shower at the first test speed. During the traverse of the shower the pilot operated the rain recorder and sketched the windscreen clearance pattern on his test card, while the navigator recorded the nozzle air pressures and temperatures on his test card.

> *"It was a high workload for the crew"*

On leaving the shower the pilot turned the aircraft for a second traverse at the next air mass flow condition which the navigator set up before re-entering the shower. When the five flow conditions were completed at one speed the process was completed at the next test speed. With practice, it was found that 15 traverses could be made through a single shower, thus covering five air mass flow conditions at three

Javelin FAW7 XH754 had been taken on charge in June 1959.
M. H. L. WATERS COLLECTION

The flight crew prepares before a test sortie.
M. H. L. WATERS

test speeds. Initially the aircraft speeds were 250, 400 and 565kt, but from the 17th flight the maximum speed was limited to 500kt to reduce rain erosion damage to the Javelin.

The report, naturally, is very matter-of-fact about this, but it looks like it involved a very high workload for the crew, especially trying to sketch the clear area on the windscreen while flying at high speed through heavy rain. At the highest speeds the passage would have taken less than half a minute. Surprisingly there is no mention of the altitude at which the tests were carried out.

On 20 April a second Javelin crew, Sqn Ldr B. Brownlow and Flt Lt J. E. Allinson, arrived at Changi by Transport Command Comet. Two days later Dr Waters and the first Javelin crew returned to the UK using the same means. Experimental flying concluded on 30 May. The trials party and the Javelin were flown back to the UK, again supported by the Hastings, reaching Farnborough on 10 June 1961.

Analysis of the nozzle configurations tested shows two combinations provided equally good clearance. Either a 4 by 0.5in (W1) or 6 by 0.5in (W4) windscreen nozzle combined with an impinging jet forward nozzle (F1) gave strips of rain-free windscreen at 250-500kt. Although visibility is usually less than half a nautical mile in rain intensities greater than 1.6in per hour, it was observed that a clear, dry screen in those intensities allowed immediate use of increasing visibility when entering lighter rain.

The pilots were of the opinion that the system would greatly assist visual flying and navigating when the prevailing visibility was greater than 2nm. They appreciated the benefits when emerging into lighter fringes after flying in exceptionally heavy rain.

The report mentions that the polyurethane coating stood up to the impacting rain extremely well. It was considered that without the coating, leading-edge erosion would have brought the trials to a premature close. This conclusion was supported by the damage to the navigation lights.

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Apparently analysis of the aluminium foil records of the rain encountered was very laborious. A calibration of raindrop size to indentation in the foil was available for the 250kt air speed, but at the highest speeds it was thought the raindrops shattered before reaching the foil. Due to the widespread interest in the trials, the preliminary report was issued in December 1961 to give an account of the work which had been completed, but further analysis of the higher-speed trials was needed.

So, was it a success? Many research programmes take so long their report is too late to influence the aspect of the aircraft being assessed. I was interested to see the TSR2 cockpit displayed at the Brooklands Museum has a very similar windscreen clearance system to that recommended by this report. In this case it appears the trials were able to help the design meet the operational requirement.

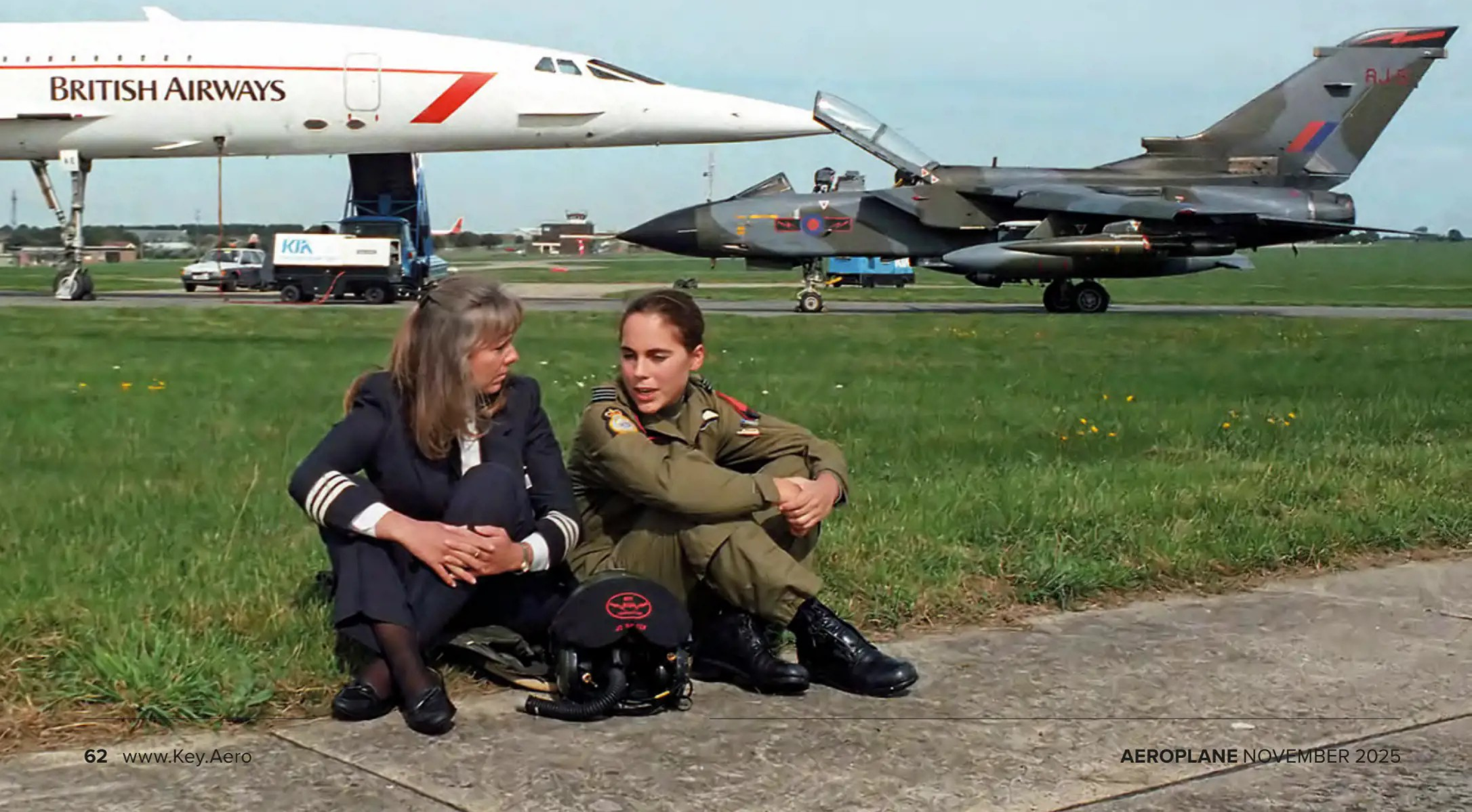
The Javelin returns to Changi having completed a test detail.
M. H. L. WATERS

BLAZING A TRAIL

In shattering the glass ceiling for women in aviation, British Airways Concorde pilot Barbara Harmer and RAF fast jet flier Jo Salter had a very public role to play. Their meeting three decades ago symbolised the overdue change finally sweeping through the aeronautical world — and underlined their status as pioneers

WORDS: GUY ELLIS

The famous image taken at Manston in September 1995: Barbara Harmer, Jo Salter and their respective British Airways Concorde and RAF Tornado GR1B mounts. ADRIAN DOWLING



Barbara Harmer in her air traffic control days. GETTY

Reluctant to be singled out to appear for the media, Flt Lt Jo Salter could not turn down the offer to meet British Airways pilot Barbara Harmer. Photographer Nick Skinner suggested and then arranged the occasion. On 22 September 1995, Jo and navigator 'PJ' Wallace flew Tornado GR1 ZA411 to RAF Manston, which British Airways used for Concorde experience flights around the UK. The next day, senior supervisor of aircraft handling Adrian Dowling marshalled Concorde G-BOAE and the Tornado for an official press party. Once the media departed the two women aviation pioneers casually sat on the grass chatting. It was this evocative image that Adrian captured and called 'A Moment in Aviation History'.

Jo was invited for a flight in Concorde. With Barbara in the right-hand seat and Jo in a jump seat, they flew north, reached Mach 2.0 and overflew Jo's base at Lossiemouth.

Their stories are as compelling as they are inspiring — journeys that began with hairdressing and led to the pinnacle of aviation excellence. On the 30th anniversary of this meeting, it is the right time to celebrate their achievements and their legacies.

After the Second World War, there were very few opportunities for women to take up flying. Despite evidence to the contrary, there remained a widespread belief that they were physically and emotionally unsuited to the rigours of aviation. It was only in 1960 that the first two women were reluctantly appointed as air traffic controllers, and not until 1987 did BA employ a female pilot. Within the RAF, women served as members of the Women's Royal Air Force but were subject to dismissal upon marriage and, later when marriage was permitted, they faced automatic discharge if they became pregnant. By 1990, WRAF members were allowed to serve as aircrew. In December 1991 they were cleared to fly combat missions, and during 1994 the WRAF was fully integrated into the RAF.

Although there was a 15-year age gap, Barbara Harmer and Joanna Salter shared an ambition — both aspired to become hairdressers.

Barbara, the youngest of four daughters, was born in Loughton, Essex in September 1953. The family moved to the Beach Estate in Felpham, Bognor Regis where Barbara attended a convent school. Her father bought a dinghy, *The Harmer Star*, on which she learned to sail. The sport became a lifelong passion. While still at school, she organised and fully managed the annual estate sailing race.

After O-levels she decided not to continue to A-levels, and as her niece Jeanne Friedman related, "She became a hairdresser because that was the sort of thing a girl would do then — hairdresser or secretary". Having qualified, she spent six years in a salon before she realised there was a whole world to explore.

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The early 1970s saw increased demands on UK airspace, accompanied by rapid technological developments in communications, radio and radar. It was into this fast-changing environment that Barbara joined the September 1974 intake of air traffic control assistants at Gatwick Airport. Completing a short introductory course, the group was transferred to the School of Air Traffic Control at Bournemouth. They went through an intensive four-week course before being allocated watches at Gatwick. Nick Lawrence wrote that his "everlasting memory will be the lady hairdresser from Bognor Regis arriving at Hurn Airport in her Ford Anglia."

In her spare time, and self-taught, Barbara successfully passed her A-levels. Her idea was to transfer to the Civil Aviation Authority's accident investigation unit, but she was thwarted by the expectation that she would 'settle down'. A birthday present of a flying lesson arguably changed her life. She took her £5,000 savings and obtained a £10,000 loan to finance further training with the British Caledonian-sponsored Mercury Flying Club based at Shoreham.

Barbara's first flight was on 26 December 1975, and under the instruction of BCal pilot and Mercury instructor Mike Thrower she earned

Grass-roots flying was a pastime of Barbara's, as in this Piper Cub. GETTY

her private pilot's licence. The next goal she reached was the accumulation of flying hours to qualify as an instructor. In that role she was employed by Goodwood Flying School. Over the next two years, studying by correspondence, she obtained her commercial licence, which she received in May 1982.

Born in Bournemouth in August 1968, aged 13 Joanna Mary Salter was pursuing her passion for hairdressing and had become a familiar face in her local Croydon salon. By 1981 there were more career options than hairdresser or secretary for young women. Jo's mother, a child psychologist, managed to persuade Jo to broaden her ambitions and opt for science subjects that would provide a broader education and allow her to take advantage of whatever life offered.

Between 1984 and 2003 the Women in Science and Engineering (WISE) campaign provided a hands-on introduction for teenage girls to explore their prospects in science and technology. When Jo discussed her plan to become an accountant, a WISE adviser pointed out, "If you study accountancy, you can just be an accountant. If you study engineering, you can be whatever you want in the world."

Her A-level subjects and results ensured her successful application to join the RAF university cadet scholarship scheme in the first year it accepted submissions from women. In 1986, at the age of 18, Jo enrolled for a BEng in electronic systems engineering run by the Royal Military College of Science at Shrivenham, Wiltshire. She was given practical assignments during the summer holidays, and for a short time she was posted to No IX Squadron operating Tornado GR1s at Brüggen in Germany. At no point was a flying role even

Advanced flying training candidates at RAF Valley in 1992, prior to the award of wings, which for Jo Salter happened on 3 April that year. VIA JO SALTER

The freshly minted Concorde first officer on the Heathrow tarmac. GETTY

Barbara in the right-hand seat on a London-to-New York service. GETTY

considered because legally women were not accepted for pilot training.

Armed with her commercial licence Barbara applied for more than 100 jobs in 1983 before she found employment with Genair. This was a small regional airline based at Humberside, and the inaugural British Caledonian Commuter partner. With 15 months flying the Shorts 330 under her belt, Barbara went for a co-pilot's position with British Caledonian, which she joined in March 1984. Here she flew her first jet, the BAC One-Eleven, and later transitioned to the long-haul McDonnell Douglas DC-10.

Upon BCal's merger with British Airways in 1988, Barbara had amassed considerable experience on large commercial jets, which subsequently presented new opportunities for her with the national flag-carrier. When an internal advertisement appeared for two Concorde co-pilot positions, Barbara applied and was selected for course 17 of the intensive six-month Concorde training programme.

> **“Barbara wanted to succeed on merit”**

Capt David Rowland met Barbara on the first day of her six-week Concorde ground school course. He wrote that he remembers “meeting a pilot who knew she had been given a wonderful chance to fly and be involved with such a unique aircraft, and a woman determined to be treated equally and to succeed on merit without any concession to her gender.”

Flt Lts Jo Salter and Paul ‘PJ’ Wallace on 12 February 1995 after formating with a Hercules for a media shoot. VIA JO SALTER

In 1994 there were only five female fast jet pilots in the world. On Jo's first trip to Goose Bay that August, one of them, US Air Force pilot Manja 'Toots' Block, offered her a trip in a two-seat F-16D, which Jo remembers as, "amazing to fly and highly manoeuvrable." VIA JO SALTER

She passed the course and on 25 March 1993 was rostered as first officer on G-BOAC flight BA001/1 from Heathrow to New York JFK. The journeys became almost routine, but she always marvelled at the power at her fingertips, the smoothness of the flight and the view from 60,000ft.

Joe Cuddy MBE, who spent 12 years serving in Concorde's cabin, fondly recalled the remarkable presence Barbara Harmer had aboard the supersonic airliner. As passengers made their way from the exclusive departure lounge to the aircraft steps, many would ask if Barbara was on the flight deck. Even frequent flyers were known to ask her to sign their coveted Mach 2 certificates. People were at ease with Barbara, who was fun to fly with, had a great sense of humour, and a genuine ability to connect with everyone.

On 25 September 1995, Barbara served as first officer on Concorde G-BOAF, which carried the victorious European Ryder Cup golf team home. Another memorable day came on 26 May 1999, when she flew the Manchester United team to Barcelona for the UEFA Champions League final. She later recalled, "I felt quite emotional as I taxied the Concorde out on to the runway, with British flags flying and thousands of people wishing the team luck on the way."

When Concorde was withdrawn from service in 2003, Barbara qualified as a captain on the Boeing 777, which she flew until she took voluntary redundancy in 2009.

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Jo's graduation in 1989 heralded a series of serendipitous events. While she was on adventurous training in Alaska the government announced on 20 July that all RAF flying posts, except fast jets, were now open to women. All women in the service were given the opportunity to sit the pilot's aptitude test, which Jo completed successfully but with little idea about the role of a pilot. She put her success down to the fact that she had developed the capacity to organise her thoughts, along with good hand-eye co-ordination from being an experienced fencer. She took up the sport aged seven and would spend hours working on exercises to hone her reflexes.

At 5ft 4in Jo was the height of the average British woman, but this was the absolute minimum for an RAF pilot, which highlighted how aircraft were built for the average male physique. Aged 21 she graduated from officer training, and a day later was informed that instead moving to engineering officer training she was to be posted to the Elementary Flying Training School at Swinderby. There Jo embarked on a 16-week course that covered ground school, a survival course and about 65 flying hours of navigation exercises, instrument and formation flying and solo flights. On her first familiarisation flight in Chipmunk WK460, Jo fell in love with flying. The Chipmunk's tandem seating replicated the fast jet layout, while it was somewhat challenging, and not all that forgiving.

Having passed her EFTS course in 66 hours with one embarrassing ground-loop, she was posted to the RAF College at Cranwell, where she learnt to fly her first jet, the Jet Provost T5A. Half-way through the course pupils were streamed to the next aircraft type. Fast jet training was still not an option for women, and she was allocated to the multi-engine stream. Her flight commander challenged the board's decision, noting that pilots with Jo's results would normally be assigned to fast jets. He proposed they send her to Valley to become a fast jet instructor, releasing a male instructor to the front line. Recalling her first trip in the much faster Hawk T1, Jo recalled, "I was sat in the back, which is quite a bit higher up than the front seat, and we flew low-level, 250ft, around the Mach Loop. It was only 30 minutes but when we landed, I was still half-way around the route because your brain can't function quickly enough at that stage. This is what I talk about; using your working memory to process information and make decisions quickly at speed. Flying in many ways is straightforward — up, down, left, right, faster, slower. The real skill is anticipating the next event, and the one after that, and adapting to a changing environment at speed."

A decision by the Royal Navy to allow women to serve on warships forced a change in the law, which opened up front-line flying to women. On 3 April 1992, Jo received her fast jet wings. She was awarded best overall student and on the honours board her name is followed by a 'w', in recognition of the WRAF which still existed until 1994.

Jo was posted to Brawdy, where she trained in tactics and air defence, developed air combat and low-level flying skills, practised with 3kg training bombs, and gained experience firing the 30mm cannon. She said of this time, "When you get onto the tactics and weapons on the Hawk, you are adding an additional level of situational awareness as you are now delivering weaponry, and this adds another layer to your ability to function effectively. I loved flying the Hawk."

She attended the Tri-National Tornado Training Establishment at Cottesmore, alongside German and Italian crews. The programme included conversion flights, instrument sorties, formation and navigation exercises, and eight intense simulator sessions focused on emergencies and terrain-following radar. The final sorties tested every aspect of the syllabus. For UK pilots, this was followed by the gruelling Tornado Weapons Conversion Unit at Lossiemouth. In 1994, Jo was posted to the legendary No 617 Squadron at the same Scottish base. It had recently re-equipped with the Tornado GR1B, fitted with the Sea Eagle anti-ship missile. Alongside No 12 Squadron it flew in support of Supreme Allied Command Atlantic.

> ***"Jo wished to be seen as just another pilot"***

Flt Lt Jo Salter achieved combat-readiness on 21 February 1995, becoming the first woman in the RAF to qualify as an operational fast jet pilot. Determined to be regarded as just another pilot, she actively avoided the limelight whenever possible.

It was some months before she agreed to take part in a one-off media day, flying a Tornado GR1B in formation with a Hercules packed with reporters and photographers, which was followed by a flypast at Lossiemouth for another press pack. The response was overwhelming. Salter enlisted the help of her fellow officers to manage the incoming mail, framing the correspondence as a collective squadron

No 617 Squadron pilots, including Jo, witness Wg Cdr Jon Dickinson handing the unit over to Wg Cdr Ian Dugmore on 7 July 1995. VIA JO SALTER

Barbara's British Airways career was defined by her time on the Concorde fleet, but carried on until 2009. ALAMY

task to avoid focus on a single individual. The only other publicity she engaged in was the famous Concorde, Tornado, Harmer and Salter photograph, which has since become Jo's favourite image.

In May 1996, Salter piloted one of the 56 RAF aircraft deployed on Exercise 'Purple Star', a major joint operation involving 53,000 American personnel. The following April, Jo made history once again, flying the first all-female RAF fast jet sortie with a navigator from No 12 Squadron.

Enforcing no-fly zones over Iraq, Jo and her navigator carried out patrols to suppress Iraqi air defence systems and gather reconnaissance data, working closely with Boeing E-3 Sentry AWACS aircraft. Missions were flown from Prince Sultan Air Base in Saudi Arabia and Incirlik in Turkey. Asked how she felt flying operationally, she says, "There aren't the feelings that I think you have when you're looking externally. What you have is a squadron or a team of people with the engineers and kit, whose expectation and training meant we just got on with the job. That was true for me, anyway, which might not be so for others. When I was 22 my mother bought me a book, *Feel the Fear And Do It Anyway* by Susan Jeffers — so, you just take a deep breath and off you go."

She had the opportunity to visit northern Iraq by helicopter to see the Kurds who were protected by the no-fly zone. "Looking into the eyes of the people on the ground and understanding the reason that you're there is quite impactful", Jo says. "Children growing up within families just getting on with their lives — they're other human beings in another part of the world. So, I think it became more personal then."

From 1996, between flying duties, Jo studied for an MBA which she completed in 1999. During this time she returned from Iraq to become a flying instructor, married and had her first daughter. When she returned to duty, she found many aspects of her life had changed, and she decided to leave the RAF.

> ***"It's important that young men and women have a purpose and place"***

Barbara's love of sailing continued throughout her life. She qualified as a commercial offshore yacht master, was successful in many competitions and — although already ill with cancer — made plans to enter the 2013 trans-Atlantic race. She was a skilled snow skier and a talented gardener, creating a wonderful garden at Felpham, West Sussex.

Her real legacy emerged from turning her reluctance to embrace media attention after qualifying on Concorde into a platform to inspire. Joe Cuddy observed, "she made an impact on people — [it was] hard not to notice her in a room. Not loud, but a presence". For her contributions to women and aviation, she was awarded the Brabazon Cup by the British Women Pilots' Association during 1993.

Following her death on 20 February 2011, aged 57, niece Jeanne Friedman wrote, "Barbara had a true love of life. She was so much fun, with her infectious laugh and a huge smile that always lit up the room. She was kind, thoughtful

In her role as trustee of the RAF Club, Jo shows the late Queen Elizabeth II a new stained-glass window at its London premises. ALAMY

and generous… she had resolve, determination, and nothing phased her. She set herself goals and sacrificed much to drive herself forward. Along the way she was kind, loving, charismatic and charming, always giving of her time and wisdom". She is commemorated by blue plaques at her birthplace and at Felpham Sailing Club.

On leaving the air force, Jo Salter entered the corporate world, rising to senior global leadership roles in a multi-national professional services firm. The move to civilian life, she admits, was "really hard" but ultimately rewarding. She was surprised by two aspects of corporate life. "The first was hierarchy. On the face of it you would think that the military was more hierarchical because of the rank structure. Yet in practice it feels far more hierarchical in the corporate world. In the military, followership is just as important as leading; it is recognising who has the skill set irrespective of rank. The second was that the military teaches you to make decisions — quickly if needed — and commit. If it's wrong, you adjust and keep moving. There seems to be far more fear of decision-making in a corporate environment."

As a volunteer she flew for 12 years as an instructor with No 6 Air Experience Flight at Benson, introducing more than 1,000 cadets to flight. She recently met two air cadets she had instructed and said, "to be able to share the love of flying with young people and to do some basic aerobatics or teach them some flying skills, to just give them that joy and then to meet people who remember it with joy, I think is just amazing."

She remains an honorary group captain in No 601 (County of London) Squadron, Royal Auxiliary Air Force, and is a former trustee of the RAF Club. Away from the corporate world, Jo is an author, educator, public speaker and humanitarian. She lectures on leadership, has published two books on personal and professional growth, and serves as an ambassador for Global Angels, an organisation supporting the provision of clean water and education projects worldwide. Her charitable work also includes trusteeship of Ripples, whose activities are focused on resource redistribution. For her contribution to education and aviation she was awarded an honorary doctorate from Bournemouth University. She was named as one of the 50 most inspiring women in the world by *Harpers & Queen*. In recognition of her RAF career, continued involvement in the aviation industry and role as an aviation ambassador at the Department for Transport, she was awarded an MBE in 2022 and in more recent years has acted as a spokesperson for the RAF.

Jo Salter's achievements demonstrated the growing role of women in military aviation, while Barbara Harmer's success symbolised the pinnacle of commercial flight during Concorde's golden era. In summing up the lessons for others, Jo feels, "It's really important that young women and young men both feel they have a purpose and place. We need to help young people become the best version of who they are supposed to be, not who we think that they should be.

"My message to young people is to give yourself permission to let yourself go and be brave. Be courageous. Step out of that comfort zone and go and see what happens, because through stretching our comfort zone is where the maximum learning is, right on the edge of panic."

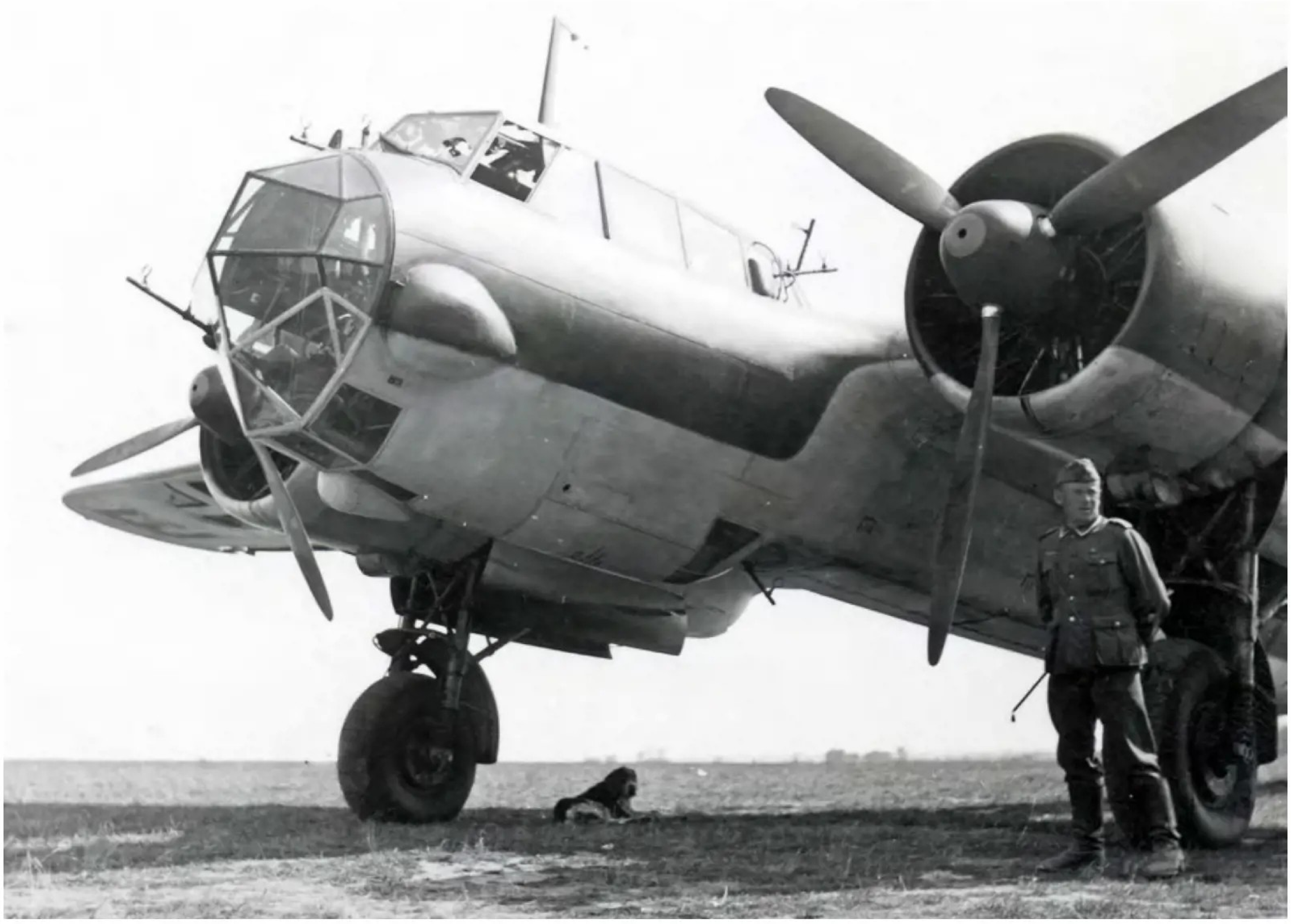
The author thanks Jo Salter and Jeanne Friedman.

ONE OF A KIND

German bomber units in the Second World War were invariably manned by Luftwaffe aircrew. However, at the start of hostilities, there was just one which — because it performed maritime attack and reconnaissance — carried Kriegsmarine officers both as aircraft commanders and as observers. And the Dornier Do 17s it used were modified specifically for maritime operations

WORDS: CHRIS GOSS

Dornier Do 17 Zs of 1./606 over Brittany in the summer of 1940.
ALL VIA CHRIS GOSS



LEFT:
A Do 17 Z-5 of 2./606 showing clearly the bulges in the nose containing flotation equipment.

Following the outbreak of war, as a result of an alleged power struggle between the Kriegsmarine and Luftwaffe over who would be in charge of maritime combat aircraft, in October 1939 Reichsmarschall Hermann Göring rejected the idea that aeroplanes assigned to the Kriegsmarine would be engaged in offensive missions, stating that in future reconnaissance of British coastal waters should be carried out by the Luftwaffe's X Fliegerkorps. All but six long-range reconnaissance Staffeln and nine multi-purpose mine-laying Staffeln would remain with the Kriegsmarine for missions over the North Sea and its approaches, while all other maritime units would transfer to X Fliegerkorps. Land-based aircraft were to remain under Luftwaffe control, Küstenflieger units using seaplanes or floatplanes being subordinated to the General der Luftwaffe beim Oberkommando der Kriegsmarine. The exception was the land-based Küstenfliegergruppe 606, or Coastal Flying Wing 606.

INSET:
Küstenfliegergruppe 606's first commanding officer, Oberstlt Hermann Edert, had a long history in the field of maritime aviation.

Küstenfliegergruppe 606 was formed at Kiel-Holtenau in November 1939. Commanded by 39-year-old Oberstlt Hermann Edert, a former Reichsmarine pilot who had transferred to the embryonic Luftwaffe in 1933, its task was coastal armed reconnaissance and attack. Unusually, 2. Staffel/606 (2./606) already existed operating Dornier Do 18 D-3 seaplanes, its first and only combat loss with the type occurring on 17 October 1939 when Gloster Gladiators of No 607 Squadron flown by Flt Lt John Sample, Fg Off George Craig and Plt Off Bill Whittey intercepted the aircraft commanded by Oblt zur See Siegfried Saloga and shot it down into the North Sea off Acklington in Northumbria. Despite an attempt by Hptm Rudolf Wodarg in another Do 18 to land and pick them up, Saloga and two crew were captured by HMS *Juno*. The gunner was killed.

Upon the formal formation of the Gruppe, it was equipped with the Do 17 Z-3 and soon became active in the Baltic and over the North Sea, its initial loss being an accident on 28 March 1940. During the Norway campaign, it carried out armed reconnaissance in the seas between Germany, Denmark and Norway, flying from Westerland. Because of its maritime nature, Küstenfliegergruppe 606 was the only unit in 1940 equipped with the unique Do 17 Z-5. A standard Do 17 Z-3 was fitted with additional flotation and survival equipment, notably two flotation devices fixed on either side of the nose, these noticeable bulges making the variant easy to recognise. Only around 40 Z-5s were built.

The first operational loss for Küstenfliegergruppe 606 came on 9 April 1940 when a Do 17 Z of 3./606 crewed by pilot Uffz Wilhelm Pohl, observer Lt Walter Priebe, radio operator Uffz Walter Schweitzer and flight engineer Uffz Wilhelm Tölle failed to return from an armed reconnaissance. Following the German successes in Norway, the unit quickly started flying from Oslo and Aalborg, Denmark, from 11 April 1940 but very little happened until July when it began operating against coastal targets around the UK.

To start with, there were only a few incidents of note. On 17 April 1940, a Do 17 of 1./606 attacked two Norwegian torpedo boats which fired back, wounding pilot Oblt Helmut Eiermann and observer Ltn zur See Ernst Rees. The next recorded engagement brought the first combat between the Gruppe and the RAF, when on 10 June a Do 17 was damaged, the observer, Ltn zur See Gerhard Prikker, being killed and flight engineer Uffz Heinz Hölscher wounded.

> ***“Navigational equipment was very primitive”***

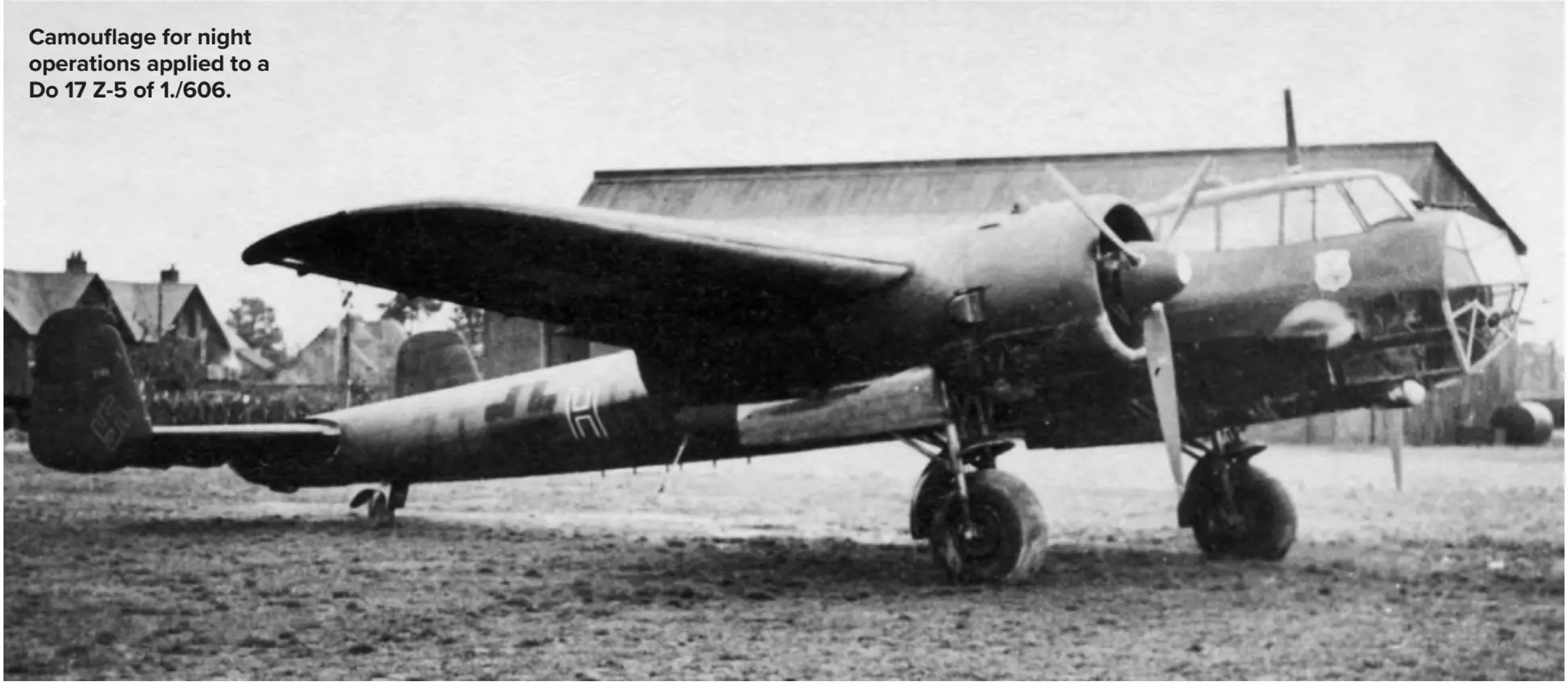
The encounter was with a No 204 Squadron Sunderland captained by Wg Cdr Edward Davis, and is described in that unit's record: “At 0705hrs one Do 215 [sic] made an attack on the port quarter out of the sun, passing beneath the aircraft after puncturing port float and port main fuel tanks with a three second burst and turning to starboard underneath. Our aircraft immediately turned up sun and dived to within 250ft of the water. The Dornier then made a second attack from astern at the same height as our aircraft puncturing starboard outer fuel tank. Sunderland rear turret gunner fired a burst during this attack and saw several tracer bullets round the Dornier (LAC T. P. J. Trickey). Dornier then took up a position 400yds astern. Sunderland made 180 degree turn to deliver frontal attack but enemy broke off engagement and was pursued for four minutes. Our aircraft returned to base three hours early due to loss of fuel. No casualties were sustained by our side.”

A low-level training flight by an aircraft from Küstenfliegergruppe 606.

Davis and Trickey were not so lucky on 21 July when they were shot down by the Staffelkapitän of 8./JG 77, Oblt Lorenz Weber. All 12 crew were killed as was Weber. Just two days later there occurred the loss of the British submarine HMS *Narwhal* to Küstenfliegergruppe 606.

From April 1940, German intelligence had deciphered several signals to HMS *Narwhal*, commanded by Lt Cdr Ron Burch, so when she set sail on 22 July her probable route was known and aircraft were sent to find and sink her. Flying from Stavanger and now led by Maj Joachim Hahn, Küstenfliegergruppe 606 was regularly active over the North Sea. A Do 17 Z in the hands of 3./606's Ltn zur See Klaus-Dietrich Siems had been damaged by three No 603 Squadron Spitfires off Aberdeen on 18 July, and later that afternoon Oblt zur See Helmut Waldecker of 2./606 had an inconclusive combat off Kinnaird Head with a No 612 Squadron Anson flown by Plt Off Desmond Isted. On the 22nd, Ltn zur See Horst Felber's 1./606 Do 17 Z was intercepted by three No 46 Squadron Hurricanes off Skegness and returned with a wounded crew member.

First blood on 23 July went to the RAF, three Spitfires of No 603 Squadron intercepting Ltn zur See Otto-Hermann Geschke of 1./606 and shooting him down 15 miles east of Peterhead. All four crew were killed and two Spitfires damaged by return fire. As this was taking place, seven Do 17s took off between 12.00 and 12.34hrs on a line reconnaissance of the North Sea. Five returned



Camouflage for night operations applied to a Do 17 Z-5 of 1./606.

without seeing anything. The same was true for the bomber commanded by Ltn zur See Bernhard Müller with pilot Uffz Wolfgang Hillmann and flight engineers Ogefr Kurt Siedentopf and Uffz Karl Kubitzki, at least until 14.54hrs.

It was then that Müller reported, "I spotted an English submarine breaking the water. In a glide flight I attacked the submarine with machine guns and released three bombs at a height of about 80m. After the aeroplane had levelled off, I was able to observe the impacts. The first was 5m short, the second was a hit, the third 3-5m wide. The bombs fell about 3m behind the tower. The submarine stood vertically, the bow protruded 3-4m above the water. After about 2-3 minutes, the submarine sank vertically. On the return flight, after having completed the reconnaissance, I saw near the place of the attack, which was recognisable by a very large oil stain, the wreckage of a lifeboat and other wreckage."

HMS *Narwhal* sank with 58 crew on board. It was soon reported overdue and on 5 August declared lost with all hands. As to the German crew responsible, none survived the war. Bernhard Müller returned to U-boats at the start of 1941, serving as first watch officer on U-584 and commanding U-633 from 30 July 1942. He and his 41-strong crew all died on 10 March 1943 when U-633 was rammed and sunk by the SS *Scorton*. Uffz Wolfgang Hillmann and Ogefr Kurt Seidentopf were killed on 29 August 1940 when they failed to return from an armed reconnaissance, while Uffz Karl Kubitzki was killed with 2./606 on 6 July 1942 when his Ju 88 was damaged over Malta by Sqn Ldr Bill New of No 185 Squadron and crashed into the sea off the south coast of Sicily.

Luftwaffe and Kriegsmarine aircrew planning a mission in December 1939.

◆

At the end of July 1940, Küstenfliegergruppe 606 moved to Lannion in western France where it was used against land and maritime targets, predominantly in the west of England and Wales. Ltn zur See Werner Techand later explained why he and other naval officers were flying with the Gruppe: "I was based with Küstenfliegergruppe 606 from 3 October to 18 December 1940. I then had to return to the navy where we were needed for U-boats. Our job was that of observers and without exception we were the commanders of the bombers because of our knowledge of navigation over the sea.

"Most of my time with Küstenfliegergruppe 606, we were acting as pathfinders for attacks on such cities as Liverpool, Bristol and London. This meant we took off at dusk across the Channel to mark the target with incendiaries. Our navigational equipment in the Do 17 Z was very primitive and, added to the inexperience of the crew and the defences over England, this resulted in a heavy loss of life and aircraft."

An example of the objectives attacked on missions from Lannion comes from 3 October 1940. At dawn, Gruppenkommandeur Maj Joachim Hahn took off together with aircraft flown by Hptm Werner Lassmann of 2./606 and Hptm Heinrich Golcher of 3./606, their target the airfield at St Eval in Cornwall, a popular one for the unit. Hahn was a great exponent of low-level formation attacks and executed another one at 08.05hrs from an altitude of 30m with good results. A similar attack was carried out the next day against the aerodrome at Penrhos, Gwynedd. It too was deemed to be successful and included attacking a freighter in Caernarvon Bay on the way home. One Do 17 was damaged and crashed into the sea just off the Normandy coast, killing Oblt zur See Paul Vollbrecht and his crew.

There were still forays to other locations. During the night of 10 October 13 Do 17s attacked the Rootes factory at Speke in Liverpool and Rolls-Royce's facilities in Crewe, while three Do 17s again bombed Penrhos, another went to Pembroke Dock and a final aircraft to Plymouth. This time they returned almost unscathed, but this would not be the case the following evening.

The strike on 11 October 1940 was described as a Dämmerungsangriff — a twilight attack. A similar effort two days before had been called off due to weather, allowing 14 aircraft to hit 10 secondary targets which led to the cargo ship SS *Alderney Queen* being sunk in St Brides Bay, western Wales. Six Do 17s, three each from 1. and 2./606, lifted off between 19.10 and 20.00hrs German time, five of the aircraft laden with six 50kg bombs and 300 incendiaries each, the sixth with 10 50kg and 60 incendiary bombs. The target for this last machine would be Birkenhead, and for the five others the aircraft factories at Crewe and Speke.

A heavily toned-down Do 17 Z-5 taxiing at Brest during October or November 1940.

Contrary to the previous night, as the six German raiders approached Anglesey, the RAF was waiting. At 18.00hrs, No 611 Squadron was warned that three aircraft were near the Scilly Isles and if they kept on the same track they would be at 14,000ft over Holyhead at 18.30hrs. Nine of 611's Spitfires got airborne from Ternhill and, at 18.20, spotted three aeroplanes 12 miles away approaching from the south-west. With the Spitfires 3,000ft above them, it was a perfect opportunity to attack. First to enter the fray was Yellow section, Fg Off Douglas 'Dirty' Watkins and Plt Off Tommy Williams (the Spitfire flown by Fg Off Ian Hay having returned with engine trouble). They were followed by Red section: Flt Lt Jack Leather, Plt Off Phil Pollard and Plt Off Jim Sutton. Blue section, Fg Off Barrie Heath, Sgt Ken Pattison and Sgt Bob Angus, was patrolling further north.

> ***"The RAF was waiting for the naval raiders"***

What happened next is related by the observer in Fw Heinrich Arpert's 1./606 bomber, Ltn zur See Jürgen von Krause: "The Spitfires attacked just before and after the target. My Do 17 had dropped back a little behind the formation and logically it was our aircraft that was attacked first. I remember that a number of hits caused problems with one of our engines. Consequently, we lost contact with our formation, turned out to sea and descended in a dive but two Spitfires stayed close…"

A precise course of events is hard to ascertain with certainty as some of the No 611 Squadron claims were a little optimistic. Barrie Heath and Tommy Williams stated 'their' Do 17 came down in the sea 50 miles out from Holyhead while Jack Leather said they had destroyed two aircraft, one crashing 10 miles south of Caernarvon, the other close to Capel Curig with two engines seen to be on fire and two crew bailing out.

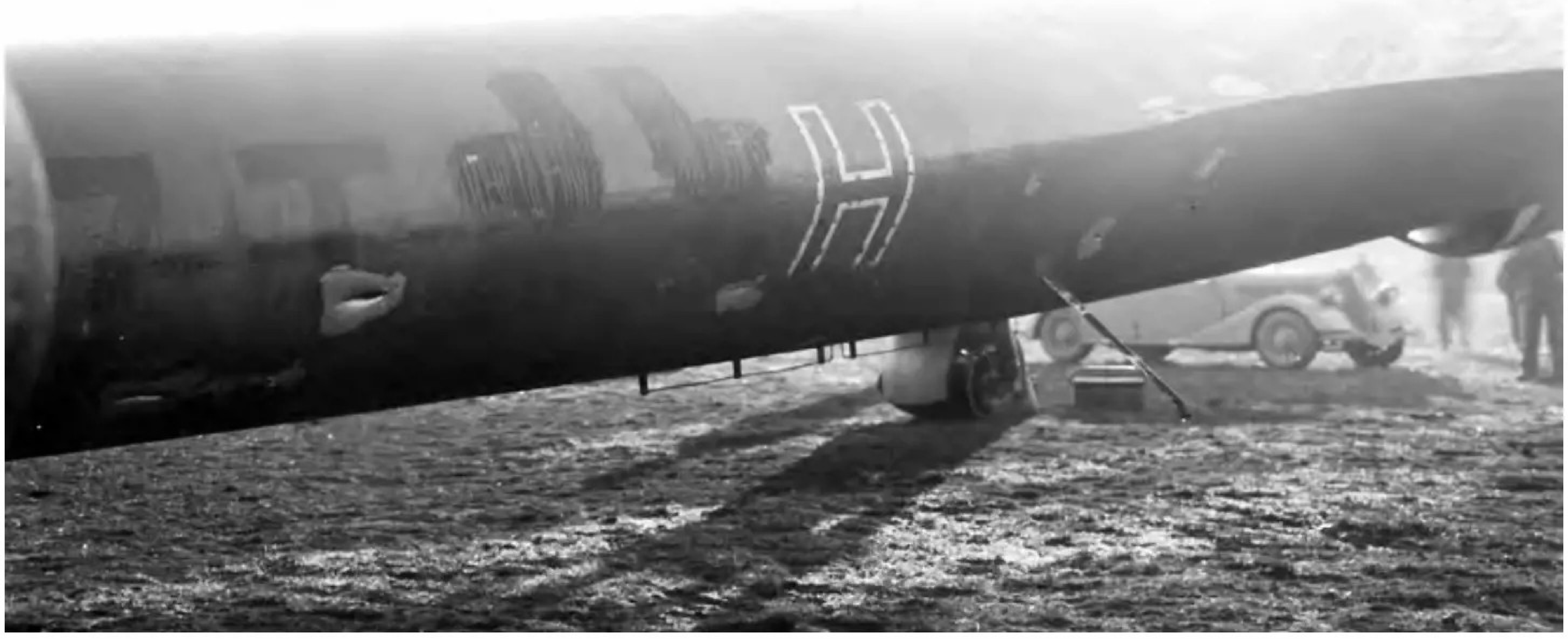
This last Do 17 was flown by Ofw Willi Hagen — badly damaged and apparently on fire, Fw Willi Staas and Uffz Heinz Johannsen took to their parachutes. Johannsen must have hit the tail as he was found dead at Deiniolen, seven miles east of Caernarvon, with an unopened 'chute, while Hans Staas landed near Bethel and was captured.

It was believed their Do 17 had crashed "somewhere in the wilds of north Wales" and that the remaining two crew members from it, Hagen and Oblt zur See Karl-Franz Heine, were missing. What really happened was that they got their crippled Do 17 back to land at Brest. The bomber showed many signs of the combat with No 611 Squadron and, sadly, of where Johannsen had hit the tail.

The two crew who managed to return with their badly damaged Do 17 were destined not to survive the war. Willi Hagen, by now decorated with the Deutsches Kreuz in Gold and recipient of the Ehrenpokal, was killed over Malta on 19 April 1942; he was posthumously promoted to Oberleutnant. Kapitänleutnant Karl-Franz Heine returned to serve on U-boats and died on 18 August 1943 while commanding U-403, which was damaged by a Hudson of No 200 Squadron flown by Fg Off Philip Harbot the day prior and finally sunk south-west of Dakar by a Wellington of the French Navy's newly formed Flottille de Bombardement 2F.

Back out at sea, 'Dirty' Watkins and Tommy Williams

The damage caused to Ofw Willi Hagen's Do 17 Z-5 on 11 October 1940 following combat with No 611 Squadron Spitfires.



watched 'their' Do 17 ditch at 18.35hrs and at least two of the crew getting into a dinghy. Williams shortly had to turn for home: "As I was breaking away from the second attack, there was an explosion in the cockpit and it subsequently appeared that I had been hit by an explosive bullet on the underside of the rudder bar. I started to bail out but then realised that the engine was still working, and so I got back in and opened up the engine to maximum to obtain the maximum height before it failed on the assumption that I had been hit either in the oil cooler or in the radiator. However, the aircraft continued to function."

Jürgen von Krause said that of the two Spitfires attacking them, they had hit one but then their remaining engine seized so they had to ditch: "The aircraft sank immediately and we were lucky to get out just in time. After some time I found our dinghy which I was able to inflate and a few hours later we were picked up by a Dutch patrol boat which took us to Holyhead."

Three of the crew were in fact recovered by the patrol boat *Amsterdam*. The pilot, Heinrich Arpert, probably went down with the aircraft. RAF reports say the German crew had ditched 16 miles off Bardsey Island at 19.15hrs, the location almost but not quite matching where Watkins' and Williams' victim crashed, but this would have been 20 minutes after the two RAF pilots had landed. Leather and Red section's kill apparently crashed 10 miles south of Caernarvon, but Red section made no mention of seeing anyone in a dinghy. The only other possibility is the 2./606 Do 17 flown by Oblt Friedrich-Wilhelm Richter; the bodies of two of his crew were washed ashore in Ireland on 26 October, and his own likewise on Anglesey on 7 November.

Further north, it was Blue section's time to get involved. They spotted two Do 17s approaching from the south-west, and by the time they were in a position to attack both were in a shallow dive heading for Speke, getting into position over Hoylake. The bombers broke left and right; one apparently unloaded its bombs on Hoylake, the other south-east of Flint where a Hurricane joined in, two sections of No 312 Squadron being ordered to patrol from Chester to Point of Ayr.

Two Czechoslovak pilots from Yellow section became separated from their leader, Flt Lt Harry Comerford. He attacked a lone Do 17 over Mold at 18.31hrs, chasing it all the way to Llangollen where he lost it in cloud. The rest of Yellow section had linked up with Red and attacked another Do 17 between Prestatyn and Chester. A chaotic if not inconclusive combat ensued, the Dornier pilot taking violent but effective evasive action. Two Hurricanes suffered stoppages to their machine guns and that flown by Plt Off Josef Jaske took bullet damage to its fabric, main and tail spars, elevator and ailerons. All returned out of ammunition and with very little to show for it.

The end result was two Do 17s shot down and one returning very badly damaged. Six German aircrew were killed or missing and four taken prisoner. On the RAF side, losses did occur but after the combat. Sgt Ken Pattison became lost and was fatally injured crash-landing just outside Kidderminster, while Tommy Williams was luckier: "I must have been hit by more than two bullets. The explosive one had broken the main undercarriage and shattered the emergency system and a number of electrical connections. The other one had shot away the pitot head and I was therefore without an air speed indicator. The third went through the rear spar, obviously an armour-piercing bullet, which struck the rear spar, splaying it out and jamming the left aileron. Fortunately it also severed the control cable between the ailerons otherwise they would have both jammed."

During the Battle of Britain, Küstenfliegergruppe 606 lost 15 Do 17s, most of which are assumed to have been the Z-5 version, on operations. A further six went the same way before the end of 1940. However, despite the popularity of the Do 17 for maritime tasks, in early 1941 the unit began to convert to the Ju 88, the last Do 17 loss on operations — and, as it transpired, the only one in 1941 — occurring on 17 February. The handful of surviving Do 17 Z-5s were then used by conventional Luftwaffe bomber units until late 1941 or as trainers. As a result, the exploits of this unique unit with its bespoke aircraft have generally been forgotten. A

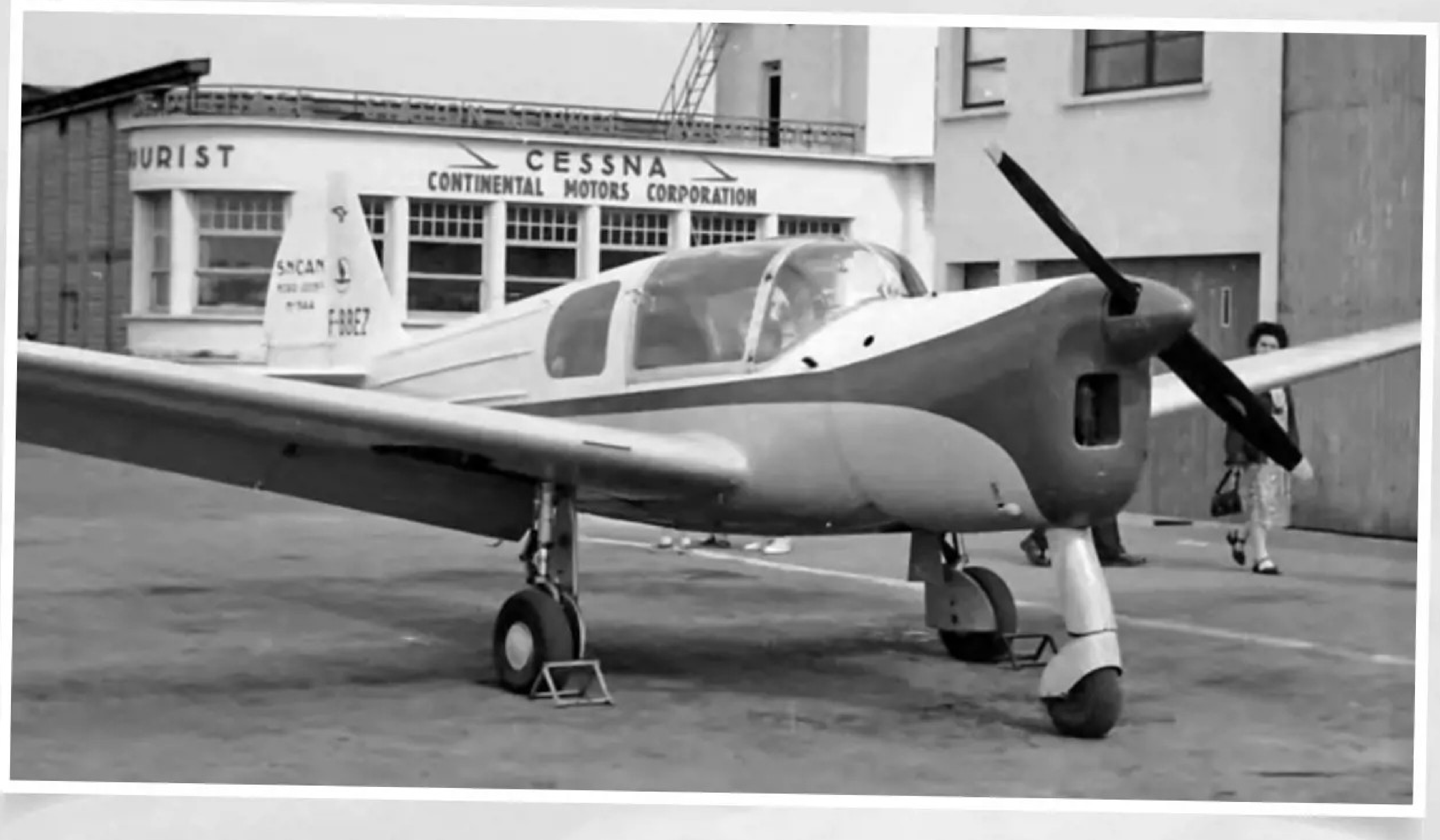
After getting lost attacking Liverpool on the night of 21 October 1940, the crew of this Do 17 Z-5 of 1./606 bailed out over Salisbury Plain, but the aircraft flew on and landed itself at Shotley in Suffolk.

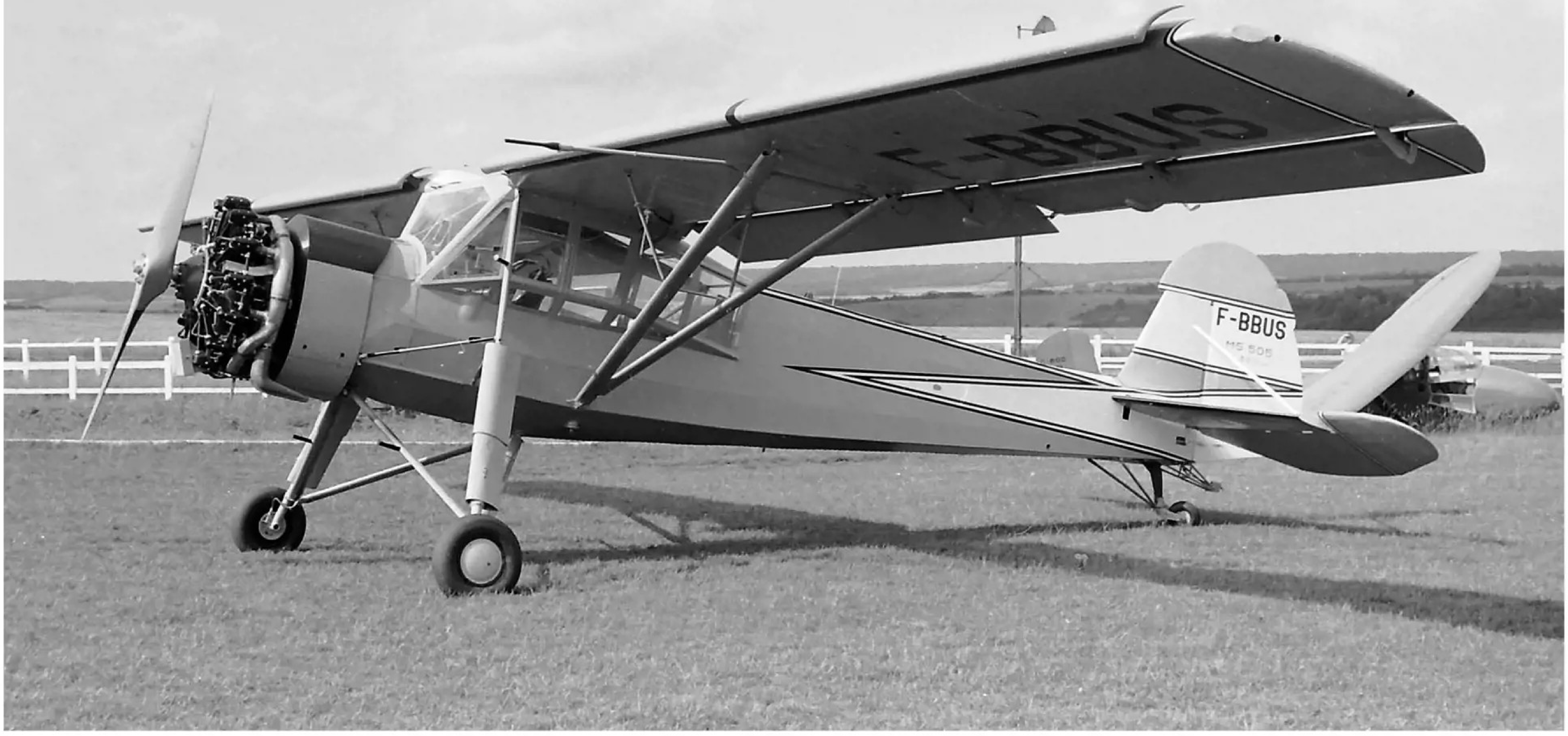
FRENCH FUN FLYERS

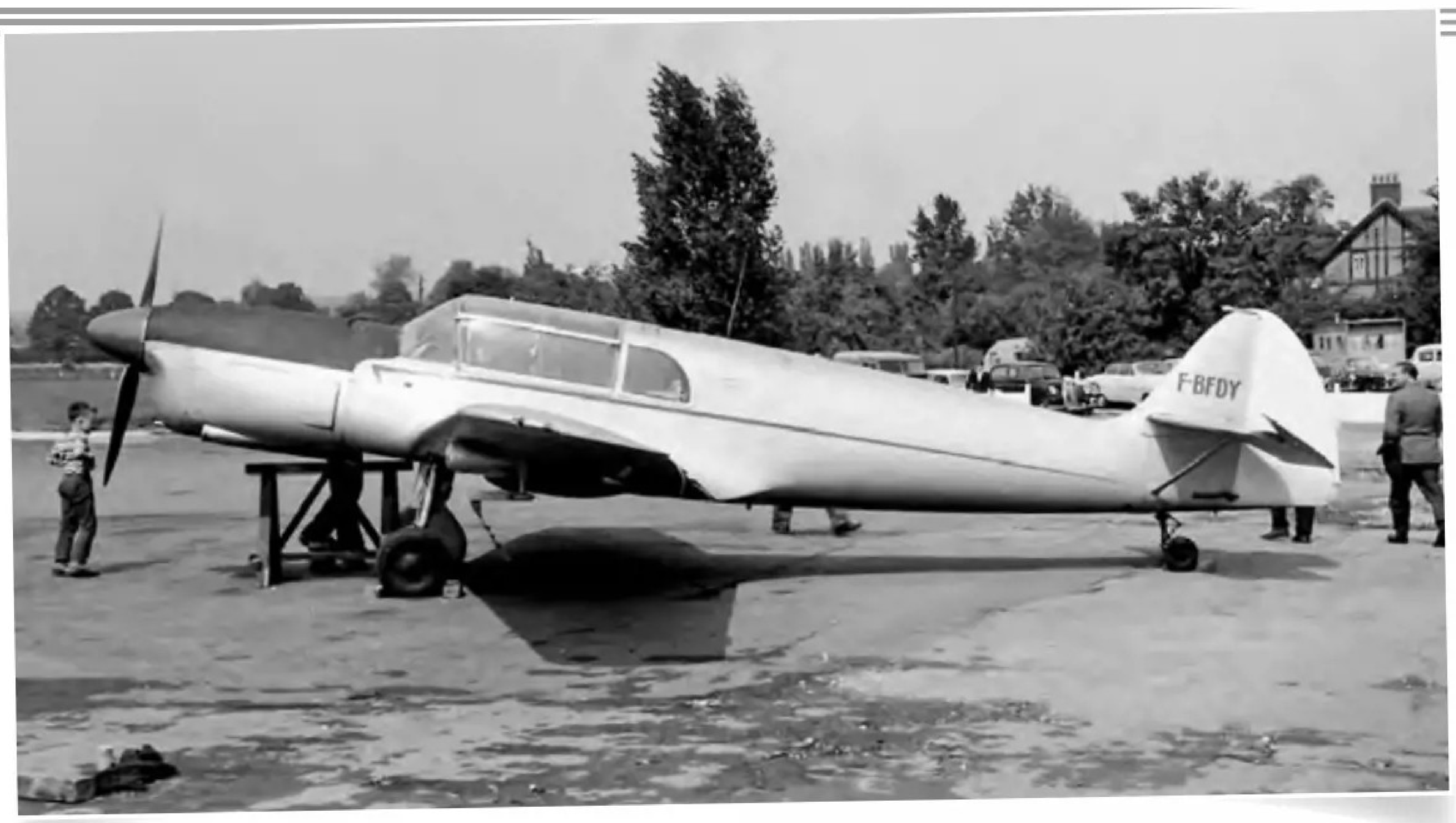
Ah, the atmosphere of French aerodromes in the 1950s and '60s... many a Morane, numerous Nords, but foreign-built classics galore, too. These photos from **Tony Clarke's** collection provide a lovely window on the time

LEFT:
Nord 1203 Norécrin F-BBEZ remains extant at Meaux-Esbly, despite having suffered an incident at Delémont, Switzerland, during 1960.

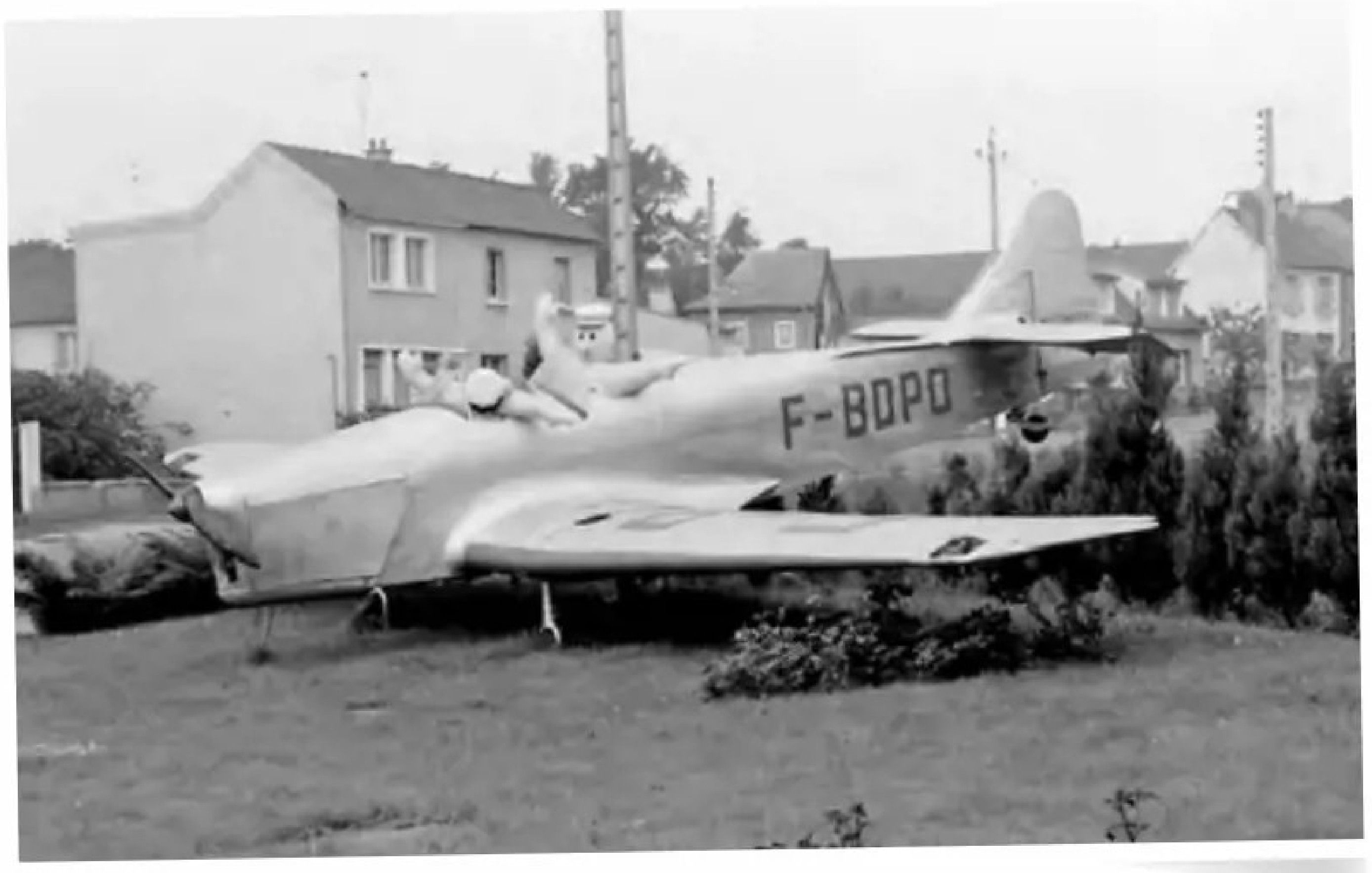
BELOW:
The Morane-Saulnier licence-built versions of the Fieseler Fi 156 Storch were very popular glider tugs with post-war French clubs. This 1945-built MS502, construction number 320, was registered F-BBUS and served with the Centre National de Vol à Voile de la Montagne Noire. As shown, it was converted to MS505 standard, replacing the 230hp Salmson radial engine with a 305hp Jacobs R-755. Today the aeroplane is still airworthy as F-AZCP, owned by the Casques de Cuir collection at La Ferté-Alais.



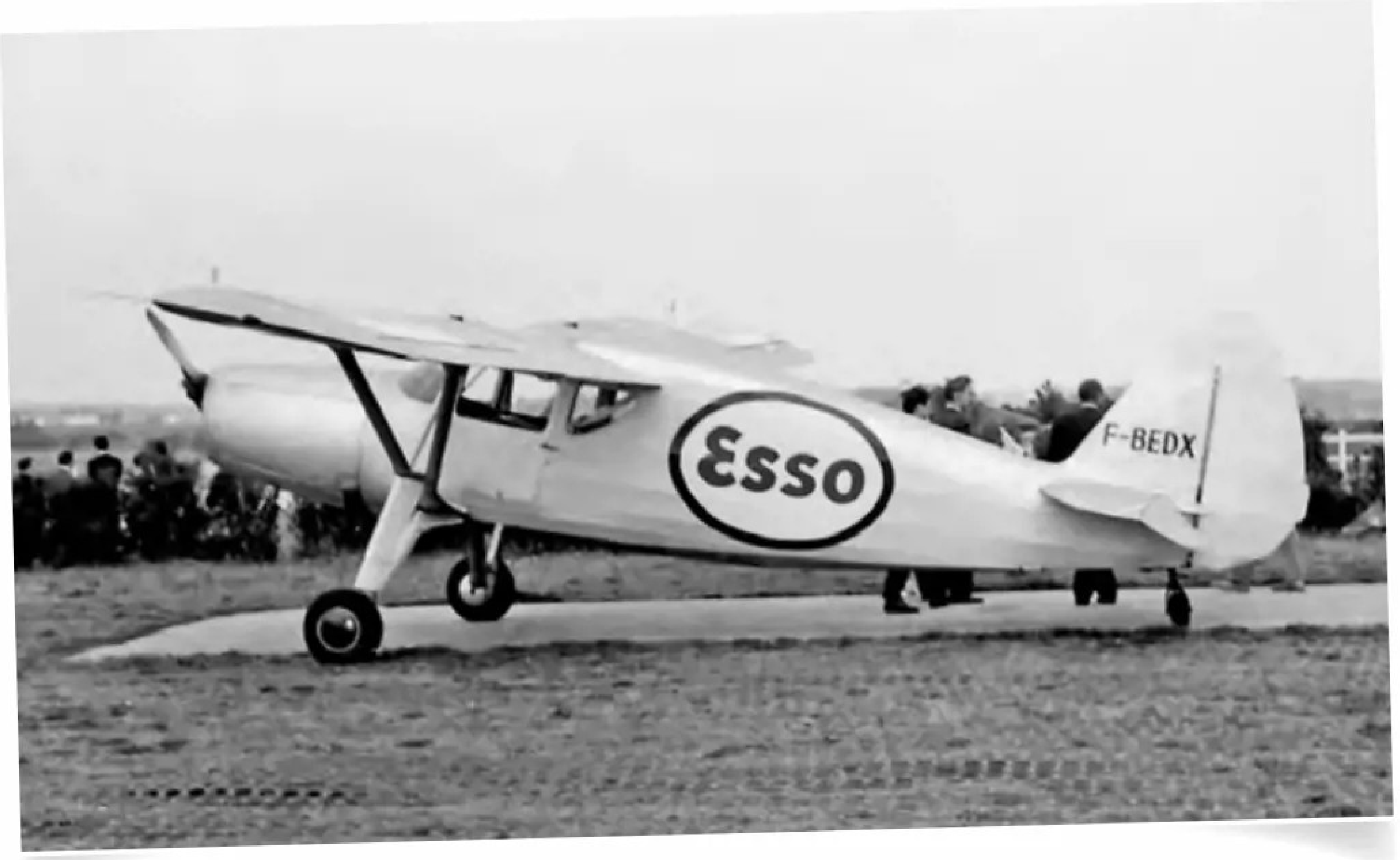




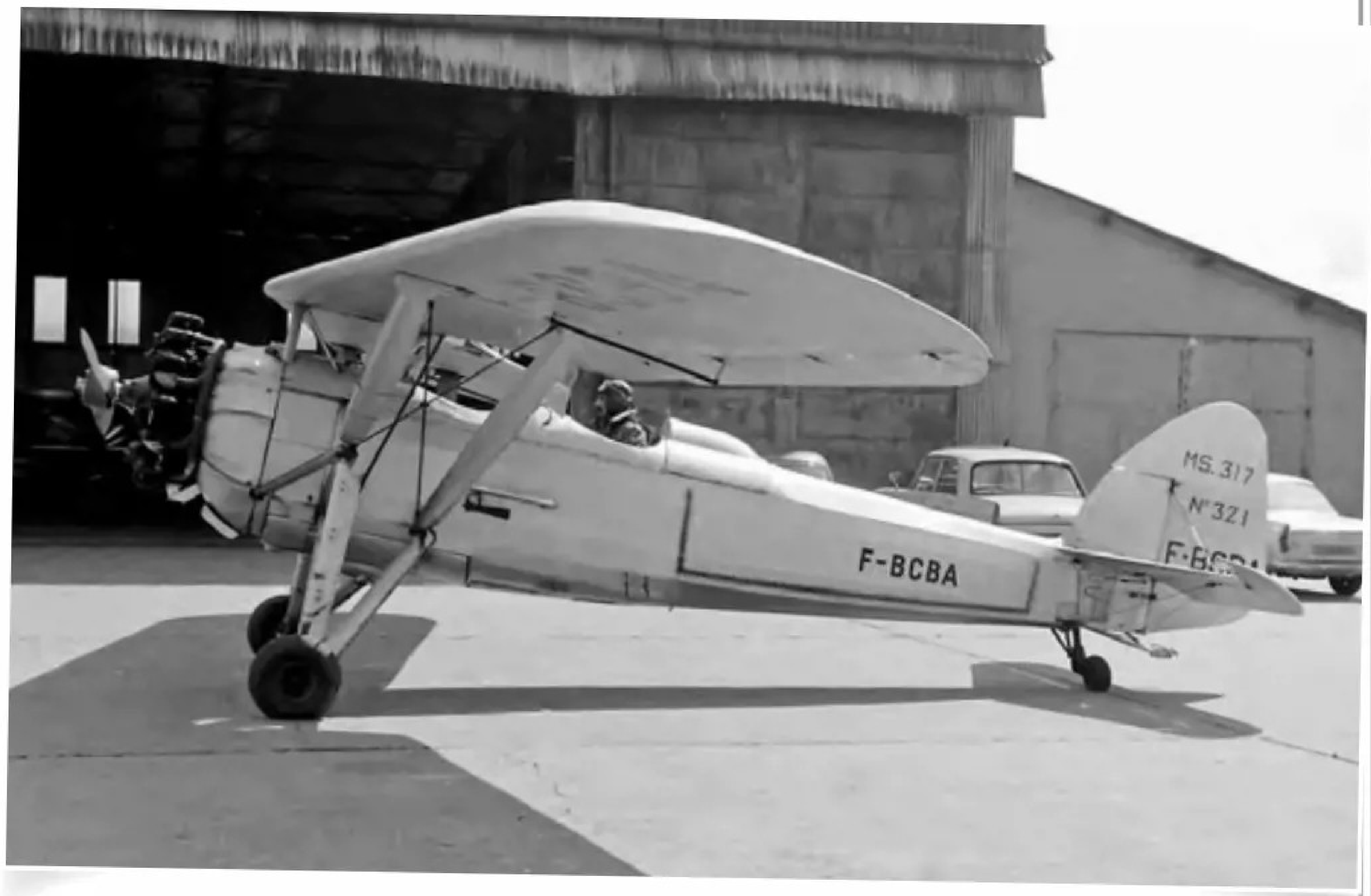
RIGHT: The familiar sight of a Nord 1002 (Messerschmitt Bf 108), this being F-BFDY, which became G-ASUA in June 1964 and was written off in a crash at Elstree the following month.



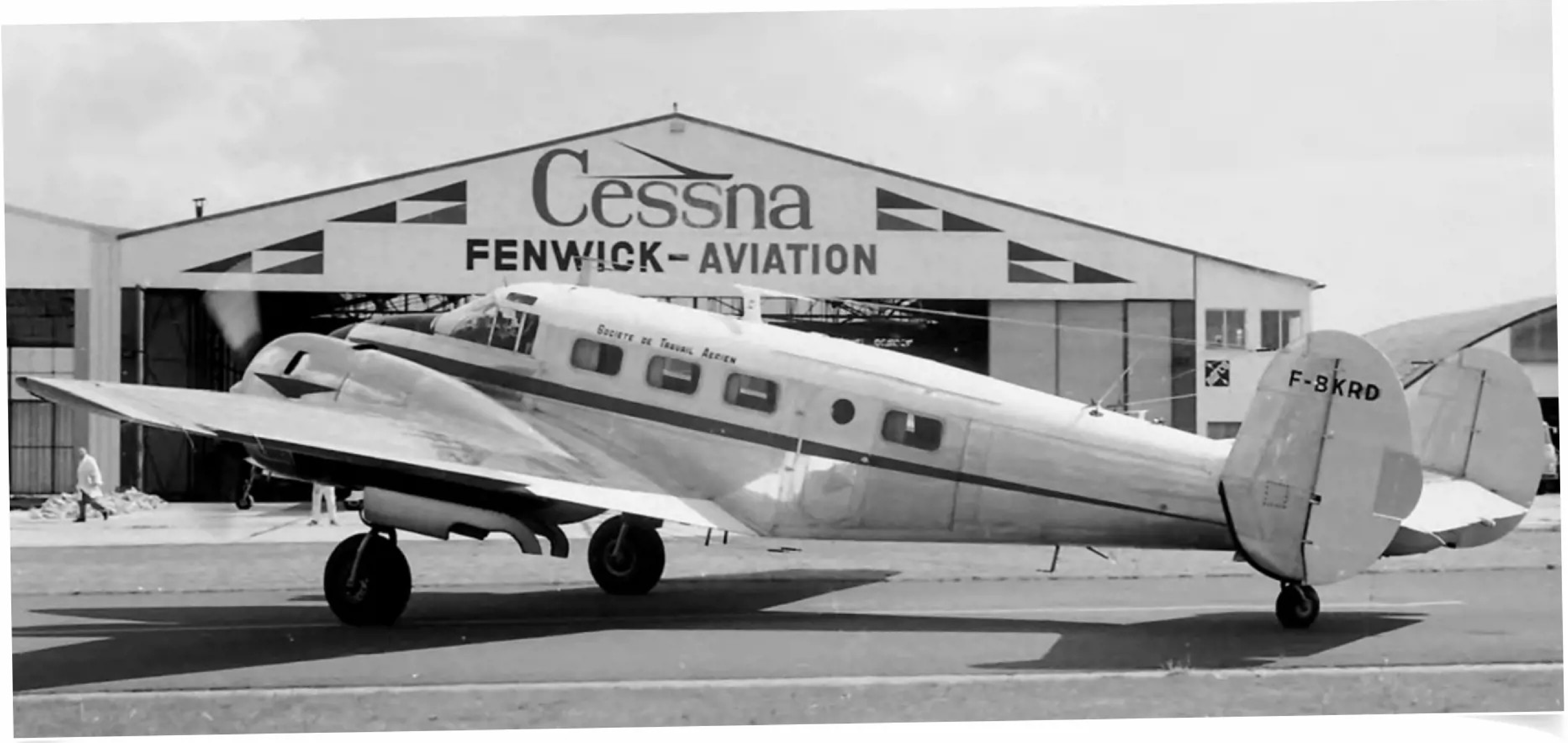
LEFT: Miles Magister F-BDPD was an unusual eyecatcher with inflatable 'crew' at a garage in Airaines, north-west of Amiens. P6423 with the RAF, it had been operated by the Aéro-Club Jean Piquenot at Cherbourg-Maupertus.



ABOVE: Fuel company branding was prominent on Fairchild Argus F-BEDX, which had been UC-61K serial 43-15029 with the US Army Air Forces and HB755 with the RAF.



ABOVE: No French aerodrome of the period would have been complete, really, without a Morane-Saulnier MS317. Glider tug-configured F-BCBA was allocated to the Paris area of the national Service de l'Aviation Légère et Sportive at Persan-Beaumont.



ABOVE: Beech C-45G F-BKRD, formerly 51-11841 and N9876Z, outside the Toussus-le-Noble facilities of local Cessna agent Fenwick Aviation. Its owner at this juncture was Escadrille Mercure.

Have you got photos to contribute to Personal Album? If so, e-mail the editor at ben.dunnell@keypublishing.com

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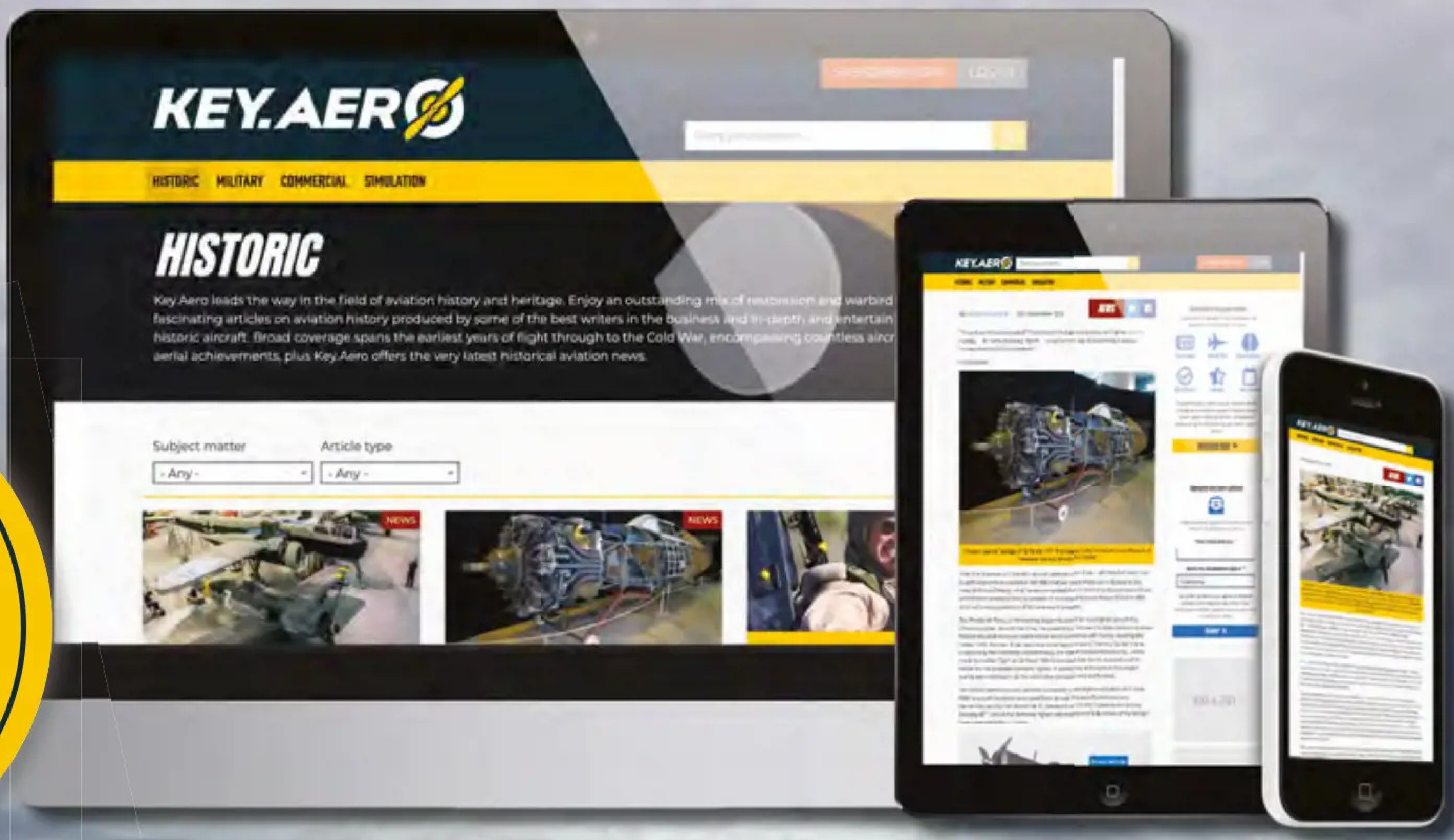

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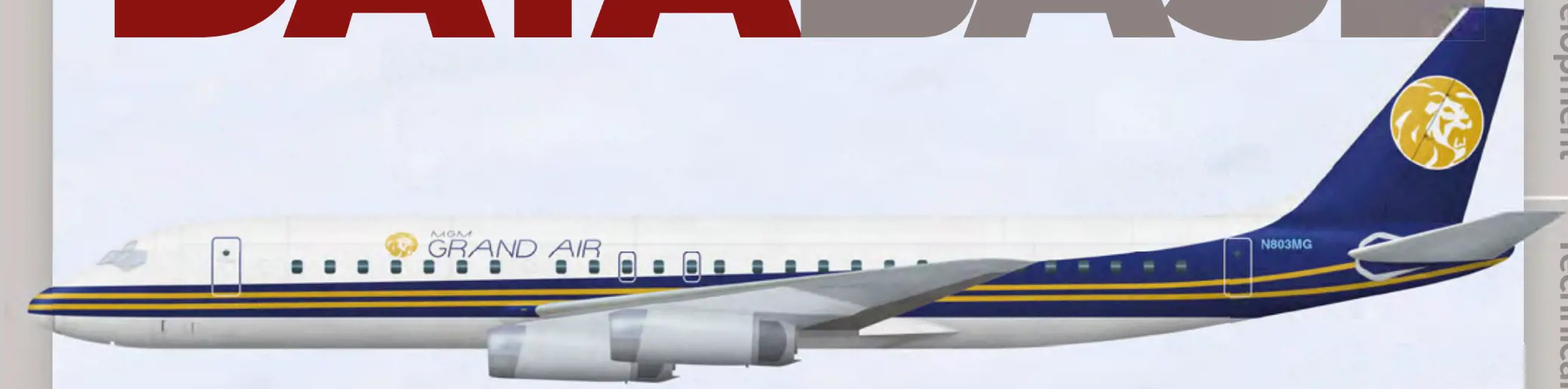


DOUGLAS DC-8

WORDS: DAVID RANSTED

23 IN-DEPTH PAGES

SWISSAIR
DC-8

TOP: DC-8-62 N803MG was one of three in the MGM Grand Air fleet, operating luxury charters and Los Angeles-New York JFK schedules from 1990-95. CHRIS SANDHAM-BAILEY

MAIN IMAGE: About to touch down at Zürich-Kloten is Swissair DC-8-62 HB-IDF Schwyz. ETH-BIBLIOTHEK ZÜRICH

The aeroplane that took Douglas into the jet transport age

The Douglas Aircraft Company of Santa Monica, California, had been at the forefront of passenger airliner evolution from the 1930s to the early 1950s, its world-beating and ubiquitous DC-3 helping carriers worldwide to establish financially viable networks. Douglas's development of four-engine types — the DC-4 derivation of its wartime C-54 and the superbly efficient DC-6 and DC-7 — had made it the global leader in airliner production. It became highly skilled at constantly improving its designs with larger, faster, longer-legged and more efficient derivatives: the DC-7C, the final iteration of the company's last piston-powered airliner, was the pinnacle of its class. This lead, however, proved a double-edged sword.

Britain's de Havilland had pioneered jet airliner transportation with the revolutionary DH106 Comet, which first flew in 1949 and entered passenger service in 1952. It focused the minds of the leading US manufacturers, but their responses to the new technology took different directions.

While Lockheed baulked on pure jets and worked on its turboprop L-188 Electra, Boeing's emphasis was given impetus by the US Air Force strategic tanker project, whose funding and findings both directly and indirectly supported the gestation of a jet airliner design.

Douglas had considered jet-powered airliners from 1943 but had been restrained partly by the limitations of jet engine technology to provide reliable and economical powerplants to support airliners of sufficient capacity and profitability, and by the comparatively effortless success of its piston designs and the post-war abundance of materials with which to build them. By the mid-1950s more than half of the western world's airliners were produced at the company's Santa Monica plant.

Donald Douglas Sr with an early DC-8 scale model. GETTY

Douglas's Military Division gathered valuable insights into high-altitude and high-speed jet-powered flight in the early 1950s, while at the same time engine manufacturers were developing more efficient, powerful and reliable jet powerplants for transport aeroplanes, with clear potential for airliner application. It already had experience in the production of military jet aircraft with the F3D Skyknight and the supersonic, carrier-based F4D Skyray.

Douglas set up a project office at its Santa Monica headquarters during 1952 to draw together the strands of research to evaluate jet technology's military and commercial potential. Progress was desultory as the company worked through its backlog of piston airliner orders and because company

'Ship 1', the very first DC-8, N8008D. The aircraft was not strictly a prototype, but acted as one. GETTY

The DC-8's maiden flight gets under way from Long Beach on 30 May 1958, water injection engaged for take-off. A Cessna T-37 flies chase. KEY COLLECTION

president Donald Douglas Sr was unconvinced the airlines were ready for jets, but it began to consider the potential for commercial aircraft resulting from the USAF requirement for a jet replacement for the Boeing KC-97 tanker.

As the Comet faltered, Boeing progressed its Model 367-80 prototype, leading to its KC-135 tanker and the 707 airliner, and combining in its passenger design the high capacity and long range to make jet transportation viable. Consequently, Boeing committed to develop the 367-80 on 20 May 1952. Douglas missed out on a share of the tanker programme, which was awarded entirely to Boeing.

Compounding Douglas's caution over launching a direct competitor to the 707 was a lack of consensus among potential customers: while Pan American favoured a large jet, both American Air Lines and United Air Lines initially preferred a turboprop and Douglas's design team, under chief project engineer Ivor Shogran, evaluated a range of options around jet versus turboprop (or a design that could allow both), four versus six engines and swept versus delta or crescent wings, as well as requirements for size, range, speed, passenger accommodation, field performance, weight and cost. Douglas even considered a turboprop version of its DC-7, to be known as the DC-7D.

This proposal was not pursued and Lockheed's Electra would become America's only four-engine turboprop airliner.

By mid-1953 Douglas settled on a design for a 125-passenger, four-engine pure jet of similar size to the 707 with a range of at least 3,700 miles. It featured a swept wing and four podded engines slung underneath it, enabling easier maintenance and maximising the fuel tank capacity in the wing.

> ***"It was a huge financial risk for Douglas given Boeing's lead"***

Initially Douglas proposed two versions, the 'Domestic' DC-8A, with Pratt & Whitney J57 turbojets (which would become the JT3), and the 'Overwater' DC-8B, with the more powerful J75 engines (later the JT4) allowing for a higher maximum gross take-off weight (MGTOW) and additional fuel tanks for longer-range operation. Market forecasts in 1953 for jet airliners in the 707/DC-8 class estimated a need for around 200 aircraft, which would fortunately prove highly pessimistic.

Douglas committed to building the DC-8 in an announcement of 7 June 1955, a full three years after Boeing had launched its 367-80. It had yielded its rival an invaluable head start, enhanced by Boeing's design and production experience gained on the large, jet-powered, swept-wing B-47 Stratojet and B-52 Stratofortress bombers and helped by government funding for development of the KC-135 Stratotanker.

Development costs were estimated by Douglas at $450 million, the costliest privately financed corporate venture up to that point. It planned to invest $300 million in the development programme up to the point of the DC-8's maiden flight, a colossal amount and a huge risk for Douglas given its rival's lead and the DC-8's higher break-even point than the 707.

At the time of the go-ahead Douglas specified a length of 140ft 6in and wingspan of 134ft 6in, although they grew and performance naturally evolved along with customers' requirements — the fuselage to 148ft 10in and the wingspan to 139ft 9in by early 1956 — throughout the planning and development period. This caused the production schedule and originally planned first flight date of December 1957 to slip.

Orders

Pan American made history on 13 October 1955 with an order for 25 'Overwater' DC-8s and 20 Boeing 707s. The airline hedged its bets for several reasons: Pan Am had a long and successful relationship with Douglas and it was swayed by the DC-8's wider cabin in the face of Boeing's reluctance to widen the 707's initially five-abreast fuselage, derived from its KC-135 design. The early JT3-powered DC-8s would lack the trans-Atlantic range and 'hot and high' capability Pan Am needed, but the airline had ordered the JT4 engine for its DC-8s, which would alleviate the problem. This meant Pan Am would have to wait for its DC-8s while the engines were developed and would put the 707 into service first, gaining valuable experience and confidence with the type.

In early 1956 Pan Am revised its order to six JT3 and 17 JT4-powered 707s. Once Boeing installed the JT4 on the 707 and developed the series -320 'Intercontinental' version, the airline favoured it, eventually operating 129 of the type. Only 19 of its 25 ordered DC-8s would be delivered, the remainder being allocated to affiliates Panagra and Panair do Brasil. Pan Am disposed of its entire DC-8 fleet before the end of the 1960s.

United Air Lines, a long-standing Douglas supporter, was targeted by Douglas as a potential launch customer. The airline was immediately interested, its president, William A. 'Pat' Patterson, strongly advocating a wide, six-abreast cabin layout to which Douglas agreed, settling on an upper cabin diameter of 147in. United became a launch customer when, on 25 October 1955, Patterson and Donald Douglas Sr — in front of representatives from 20 of the world's leading airlines — signed a record-setting $175-million deal for 30 of the jets, deliveries to begin in May 1959. It later amended its order to 18 JT3C-powered aircraft and 22 series -21s with more powerful JT4A-3s.

> **“About 95,000 people watched the take-off”**

On 7 November National Air Lines placed an order for six DC-8s and in December Douglas gained another big win when Eastern Air Lines bought 26. Atlanta-based Delta Air Lines made an opportunistic move when Eastern cancelled the first six of its order as CEO Eddie Rickenbacker became frustrated with the expected performance shortfall of the JT3C-6 powerplants slated for installation on the early DC-8 airframes. The decision proved a classic case of foot-shooting as Delta — a rival of Eastern in the south-eastern states — quickly grabbed the early delivery slots for the already under-construction airframes.

Loyal Douglas customer KLM Royal Dutch Airlines became the first foreign airline to order the DC-8 on 16 November 1955 with a contract for eight JT4-powered 'Overwater' examples. The Dutch flag-carrier would be the only airline to operate all the main Douglas commercial types, from the DC-2 to the MD-11.

Boeing, its confidence shaken by the big contracts from Pan Am, United and Eastern and threats by American's president C. R. Smith not to order the 707 unless its fuselage was widened, finally agreed to the redesign. With its six-abreast cabin, faster speed, lower price and the new-found range of the Intercontinental version, Boeing opened up a lead it was never destined to lose.

N8008D
DC-8
DOU

Long-time Douglas supporter American Airlines chose the 707 over the DC-8, partly because of Boeing's head-start in jet transport development experience through its military programmes and partly because those military contracts brought down the unit price of the 707 to $500,000, around 10 per cent below the DC-8. But what really clinched the deal for American was Boeing's eventual, grudging agreement to widen the 707's cabin by 10in to enable six-abreast seating.

American was also concerned the DC-8's 30°-swept wing made the aircraft slower than the 707 — critical on the blue riband transcontinental run — which it saw as a major disadvantage. In the 1950s battle between Douglas and Lockheed a key factor had been the near-obsession of transcontinental rivals TWA, United and American with coast-to-coast speed, and the 707's 35° wing sweep was expected to make it around 20mph faster, significantly enhancing its appeal. As 1958 dawned, Douglas and Boeing were running neck-and-neck, with 133 orders for the DC-8 versus 150 for the 707.

Construction

In June 1956 Douglas announced plans to build the DC-8 at its historic Santa Monica plant but in order to do so needed the 5,000ft-long, 150ft-wide runway extended, which the city refused in the face of concerns by residents over noise levels. The company decamped to a new factory at Long Beach airport, with its 10,000ft-long, 200ft-wide runway. Douglas had originally used the Long Beach site for building Boeing B-17s under licence during World War Two and later to produce the C-124 Globemaster II and C-133 Cargomaster.

Two new final assembly buildings and a paint shop

N8008D was the first of eight DC-8s assigned to flight-testing of the new type.
KEY COLLECTION

were constructed for the DC-8: fuselage construction began in Building 84 while wing production got under way next door in Building 80 on the eastern side of Lakewood Boulevard. When completed, the wing assembly was moved into Building 84 for mating with the fuselage. Additionally, a large water tank was erected for analysing metal fatigue from repeated pressurisation of the hull. On 26 March 1958 the first aircraft was fitted with four Pratt & Whitney JT3 engines. Following construction the DC-8s were towed across Lakewood Boulevard — which bisected the site — overnight to the west ramp for final fitting-out before first testing could commence.

Although officially there was no DC-8 prototype, N8008D (c/n 45252, 'Ship 1') emerged from the Long Beach hangar on 9 April 1958 with Donald Douglas Sr in the left-hand seat on the flight deck and Donald Douglas Jr, who had succeeded him as president in 1957, to the right. It was positioned for comparison purposes with a DC-3, DC-4, C-118 (military version of the DC-6) and DC-7. At the roll-out ceremony, which featured stewardesses from the DC-8's 17 launch customers, the company announced an improved sound suppressor design, reducing noise levels by 10 decibels by employing an ejector sleeve at the rear of the engines which moved aft for take-off and landing, lengthening the exhaust outlet. After its roll-out 'Ship 1' was employed in low, medium and high-speed taxiing trials.

Into the air

The DC-8 flew for the first time on 30 May 1958 at Long Beach airport for a two-hour seven-minute flight — mostly over the Pacific Ocean — under the command of chief pilot Arnold C. A. G. 'Heimie' Heimerdinger. With him were co-pilot Bill Magruder, flight engineer Paul Patton and flight test engineer Bob Rizer, monitoring the flight data recorders in the cabin. The choice of this date, the Memorial Day holiday, was to enable the maximum number of workers to join the historic moment and around 95,000 people were on site to watch the take-off.

During the faultless maiden flight, which ended at Edwards Air Force Base — where the majority of the DC-8's flight-testing would be conducted — the aircraft reached an altitude of 21,000ft and a speed of 402mph (350kt) with a take-off weight of 198,000lb and MGTOW of 255,000lb. It was joined by a US Air Force Cessna T-37 chase-plane and a United Air Lines DC-7 carrying press photographers eager to gain images of what Douglas heralded as, "the world's most advanced jetliner."

Douglas committed eight DC-8s and 26 test pilots — augmented by a Link trainer simulator — to the type's flight test programme. This unusually large number of aircraft helped make up some ground on the 707 and enabled the company to test, improve and in some cases discard a range of innovations and features in both the airframe and its powerplants, in various configurations and combinations.

Each of the 26 pilots had at least 15 hours of simulator time before being given command of a DC-8. The aircraft used for flight-testing could be identified by the blocked windows between the forward passenger entry doors and the wings, used to conceal the test equipment in the cabin, and by the forward-pointing data booms on the wingtips. Every new DC-8 variant was tested up to a top speed of Mach 0.95.

Flight tests, however, highlighted some performance issues. Drag was 13 per cent above the designers' forecasts and 10 per cent higher than Douglas had promised its customers, due in part to inaccurate projections based on wind tunnel testing and resulting to an extent from the wing design and engine placement. Moreover, the early JT3C engines achieved only Mach 0.798 rather than the 0.84 performance guarantee, although the newer JT4As would narrow the gap.

Donald Douglas Sr was adamant that the

performance guarantees be honoured. Thus, Douglas was forced to redesign the wing leading edge, allowing additional fuel tankage, to reshape the engine pylons, extend the wingtips (increasing the wing area by 3.25 per cent), lengthen the leading-edge wing slots and effect a 4 per cent chord increase. With the addition of a more pointed nose, these enhancements — which became standard on -40 and -50 aircraft — reduced drag, improved payload and range and provided a small speed increase.

Due to the pace of production, new-build airframes could not incorporate the wing changes until the 148th aircraft off the line and retrofitting earlier ones proved complex and costly. The modifications didn't entirely close the performance gap, especially on range, and Douglas resorted to offering a financial inducement for customers, significantly impacting the programme's forecast profitability. It kept them on side with promises of future upgrades.

Fuselage assembly on the Long Beach line with 'Ship 34', a DC-8-21 destined for Eastern, in the foreground. ALAMY

Douglas continued to steadily improve the DC-8's performance throughout the 1960s. While it was a successful strategy, this stretched the resources of its engineers and designers — delaying the launch of the short-haul DC-9 — and the setbacks produced an early crisis of confidence within Douglas's senior ranks, some executives even calling for the company to cut its losses and exit commercial airliner production altogether, thereby leaving the field entirely to Boeing. Its president, Don Douglas Jr, and vice-president Bob McGowan elected to carry on pushing ahead and during 1961 the former reaffirmed Douglas's ongoing commitment to the DC-8.

The major upgrades began to arrive in 1960 with the change to the more powerful and efficient JT3D turbofans, significantly enhancing performance and boosting the DC-8's range. A first airframe to be equipped with the new powerplant — designated as the series -50 — took flight on 20 December 1960.

The DC-8-11 received its FAA certificate (without wing slots) on 31 August 1959, 14 months after its maiden flight had taken place. With a length of 150ft 7in, a wingspan of 139ft 7in and powered by 12,500lb-thrust Pratt & Whitney JT3C engines, the -11 was certified for a cruise speed of 590mph and a range of 3,900 miles with a MGTOW of 265,000lb, configured for 116 passenger seats.

When 'Ship 2' made its maiden flight on 29 November 1958 it carried the improved JT4-9 engines, evaluation of the JT4 and Conway powerplants leading Douglas to revise upward the MGTOW with both types to 310,000lb.

DATAFILE

THE DAY THE DC-8 WENT SUPERSONIC

It's sometimes reported that when, on 21 August 1961, a DC-8 became the first airliner to break the sound barrier — eight years ahead of the Tupolev Tu-144 and Aérospatiale/BAC Concorde — this was a spontaneous, unplanned event. In fact, it was a well-researched and prepared experiment conducted under test conditions.

The DC-8-43, c/n 45623, was the 130th to be produced. It carried Douglas test registration N9604Z, later becoming CF-CPG with Canadian Pacific Air Lines. Under the command of Bill Magruder, with flight test crew Paul Pattern and Joseph Tomich and flight test engineer Richard Edwards, it was flown to 52,090ft, also a record for a commercial airliner at the time. Accompanying it were a Lockheed F-104 Starfighter, flown by 'Chuck' Yeager and with instruments calibrated to verify the achievement, and a North American F-100 Super Sabre which filmed the event.

The plan was Magruder's idea, eager to demonstrate the DC-8's inherent strength and steal a march on the 707. He applied around 50lb of 'push', putting the aircraft into a shallow dive from 52,090ft above the Askania tracking range at Edwards AFB. After experiencing some buffeting at Mach 0.96, the DC-8 reached Mach 1.012 (660.6mph) at 41,088ft for around 15 seconds. As the shockwave left the wing it caused the ailerons to flap up by around 5°.

Pulling out from the dive, the elevator proved ineffective; opting to use the stabiliser, this too would not co-operate due to the aerodynamic loads placed on it. The experienced Magruder intuitively pushed further into the dive, relieving the pressure on the stabiliser, achieving full recovery at 36,000ft.

Powered by Rolls-Royce Conway RCo 12 Mk512 engines, the DC-8 was fitted with 5,000lb of ballast in the rear fuselage to move the centre of gravity aft, helpful — along with the stabiliser trim — in maintaining manoeuvrability during the pull-out from the dive, but was otherwise in standard configuration. The aircraft reached a descent speed of 500ft per second and the maximum g-loading during the pull-out was 1.70. This remains the only recorded occurrence of an airliner other than Concorde or the Tu-144 achieving supersonic flight.

The ability to stretch the DC-8 design — this is -63 N1503U, destined for KLM, on test — was built in from the start. GETTY

Douglas chose a wing sweep of 30°, rather than the 35° of the Boeing 707, for several reasons. The design enabled better low-speed handling and lessened the phenomenon known as Dutch roll, a combination of yawing and rolling. Capt Jon Ludgater flew the DC-8-55 freighter and recalls the type had "almost no Dutch roll tendency, something that was made very apparent when flying with first officers who had come from the 707 who were amazed at how much better the handling was, mostly due to the slightly reduced sweepback angle". The 30° sweep was additionally felt to help flight crews transition more smoothly from piston-engine airliners by producing low-speed characteristics closer to those of the DC-7.

The maker had become adept at building 'stretch' into its designs and the 30° sweep would later give the DC-8 a crucial advantage over the 707: its angle would allow for a major fuselage lengthening which the 35° of the 707 wing — and its shorter undercarriage — could not match. This enabled Douglas to produce the DC-8-61 and -63 which at the time were the largest-passenger capacity jet airliners in the world, giving the whole programme a much-needed boost.

The DC-8 wing was of triple-spar, triple-torque box design with slotted flaps. It had no leading-edge slats but incorporated a slot inboard from each engine pylon, an actuator opening a door in the wing's leading-edge lower surface and pulling the upper surface down to provide a

Swissair passengers using the rear entrance to board. ETH-BIBLIOTHEK ZÜRICH

A fine example of a Conway-engined variant is Canadian Pacific DC-8-43 CF-CPJ, named *Empress of Toronto*. GETTY

smooth inner surface. The wing was designed with a high degree of stiffness both for strength and for improved crosswind handling, and featured a horizontal twist along its length to assist aileron effectiveness as the wing approached a stall.

The high-speed aerofoils, with varied geometry — greater curvature on their underside closer to the wing root, and on their upper surfaces at the mid-span and towards the wingtip — brought increased stability and performance through a greater level of drag divergence Mach number of 0.84 for the wing's 30° sweep, a figure that, without the aerofoils, could otherwise have only been achieved with 35°.

The double-bubble fuselage of the DC-8 satisfied customer requirements for better passenger headroom, greater cargo hold capacity and a comfortable six-abreast cabin. It had grown to 150ft 7in long with a larger upper and smaller lower circle, the circles meeting at the cabin floor level, and a constant-section design to facilitate future lengthening.

Two main passenger entry doors were envisaged, fore and aft on the port side, with cargo hold doors on the lower starboard side. As a safety measure, the plug-type passenger doors, slightly larger than the opening, pivoted inwards before opening outwards.

To provide an additional safety feature, Douglas pioneered the use of titanium 'rip-stopper' strips on fuselage frames and around door and window cut-outs as a means of preventing fatigue cracks and adding strength. A distinguishing feature of the DC-8 was the pair of 'chin' air intakes on the underside of the nose for the cabin air and air conditioning packs.

Like the 707, the DC-8's four-wheel main undercarriage rotated inward 90° into the fuselage while the steerable twin-wheel nose gear rotated forward. The main gear was designed to allow the rear pair of wheels to unlock and swivel, enabling 180° turns on runways and tighter turns on narrow taxiways originally intended for piston airliners without scrubbing the tyres.

Douglas evaluated, and then discarded, several innovations during the development and testing phases. The first two DC-8s had speed-brakes on the lower rear fuselage, but these were removed as they proved ineffective. Instead, 'thrust ejector ring' thrust-reversers — featuring clamshell doors which could be closed to redirect the thrust to reduce speed — were fitted at the rear of each engine nacelle. The reversers, which could be deployed in flight as well as on landing, entered testing on the third DC-8 produced, becoming standard until the -50 series brought in a new thrust-reverser system.

> ***“Douglas evaluated and discarded several innovations”***

The manufacturer's interior design team for the DC-8, led by Jack Graves, patented the 'Palomar unitized seat,' designed for comfort with built-in reading lights and crew call buttons located in the front of the seat back behind the passenger's shoulder while fresh air vents, tray tables and oxygen masks were positioned in the rear of the seat backs. The team devised maximum flexibility for airlines, including moveable bulkheads, floor-mounted seat tracks to allow for customised seat row spacing and electrical umbilical cords connecting each seat row's power to sidewall manifolds.

The DC-8's cabin windows were triple-paned to provide an abundance of strength against expected pressure, learning from the Comet 1 experience. This brought an additional benefit of providing the same degree of soundproofing as the fuselage walls. The windows' size — much larger than the 707's — was appreciated by passengers, not least as it increased natural light, but their double-spacing proved an issue later when certain airlines reduced seat pitch to accommodate more rows, leaving some with no outside view.

Up front, the spacious, modern cockpit provided ample room for pilot, co-pilot, flight engineer and, for long over-water sectors, a navigator.

Powerplants

The initial engine choice for the DC-8 was the Pratt & Whitney JT3 turbojet, a civil development of the J57 suited to the domestic version of the aircraft. It was envisaged that the more powerful JT4, a derivative of the military J75, together with the Rolls-Royce Conway and the General Electric CJ805, a version of the military J79,

The cockpit of a KLM example at altitude.
NATIONAAL ARCHIEF

would power later models, enabling transoceanic range.

The early JT3s employed a water/alcohol injection system on DC-8s — using 5,000lb of water/alcohol mixture, a hefty payload penalty — which provided denser, cooler air for enhanced combustion, allowing larger amounts of fuel to be injected for take-off. It made for a very smoky departure and the 5,000lb capacity was sufficient for only a single take-off, a problem on the multi-sector long-distance routes operated by many international carriers and in crew training. The more powerful JT4 and Conway, in addition to enabling long-range operation and an increased MGTOW of 287,500lb, would eliminate the need for this complex and expensive cooling system, bringing a significant weight saving, eliminating the mixture and the four (one per engine) 190-gallon tanks. Not surprisingly, most of the early JT3-powered DC-8s were retrofitted with JT4s.

The JT3C-6 engines installed on ‘Ship 1’ (N8008D) were not fitted with thrust reversers, although these were added for all DC-8s from the third airframe onwards. Cookie cutter-style ejector ring shrouds at the rear of the nacelle could be moved aft on a track on the underside of the pylon. Buckets either side of the ring moved into place behind the engine to act as a thrust reverser and the reversers could be used in flight to act as a speed-brake during descent.

One flight engineer describes this in action: “In its cargo configuration, with a payload of 96,000lb, the DC-8 proved immensely tough. When operating empty, they would sometimes end up at FL410 over Europe in the middle of the night. More than once, for ATC purposes, they delayed their descent and then put the gear down and used reverse on all four engines to drop like a stone. I can’t imagine this ever being done on a passenger flight. Not surprisingly, though, when the aircraft went for a check at Gatwick, they found cracking in the pylons.”

> ***“The reversers could act as speed-brakes”***

Aiming to expand the DC-8’s appeal and improve on its performance — as Boeing was doing with the 707 — Douglas developed the series -40, powered by Rolls-Royce turbofans. The first, DC-8-41 N6577C (c/n 45442, ‘Ship 9’), using 17,500lb-thrust Conway 12s, joined the flight test programme on 23 July 1959, initially delivering an aircraft with MGTOW of 302,000lb and a range of 5,450 miles at maximum payload. The Rolls-Royce engines, in combination with the wing improvements, brought big performance gains, raising the DC-8’s range by 8 per cent and cruising speed by 12mph, while the aircraft’s

United
N8099U
United

A test involving DC-8-61 N8099U of United to assess the use of thrust-reversing for a steep approach capability.
NASA

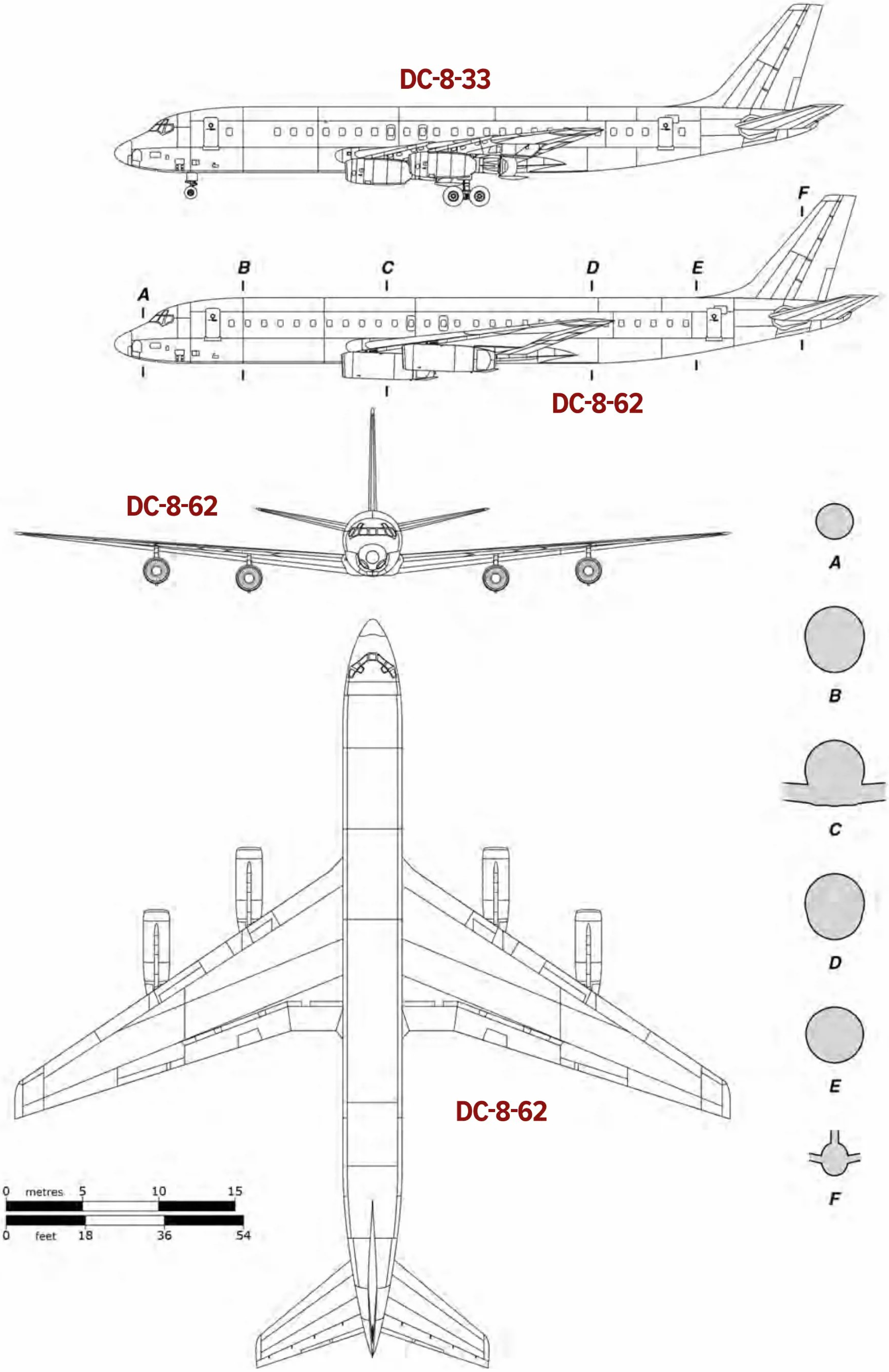
maximum payload grew by three tons.

Following the DC-8's first flight Douglas announced that both the JT4 and the Conway would enable the aircraft's MGTOW to be increased to 310,000lb, allowing more fuel capacity and range with no payload penalty.

As engine development continued apace, Pratt & Whitney announced the JT3D turbofan, improving the mix of fuel and air and allowing the forward fan section to surround the hot engine exhaust with cooler air, bringing greater thrust and fuel-efficiency while reducing engine noise. The engines incorporated new thrust reversers and exhausts, removing the old 'daisy petal' design, and were attached by a modified pylon. The first production 'fan jet' DC-8s with the JT3D would be the series -50 model.

DATAFILE SPECIFICATIONS: DC-8 *(Note: some specifications changed from their original certification)*

	Series -10	Series -20	Series -30	Series -40	Series -50	Series -61/71	Series -62/72	Series -63/73
POWERPLANTS								
	Series -11/12: four Pratt & Whitney JT3C-6s, 13,500lb thrust each	Series -21: four Pratt & Whitney JT4A-3s, 16,800lb thrust each	Series -31/32: four Pratt & Whitney JT4A-9s, 17,500lb thrust each; Series -33: four Pratt & Whitney JT4A-11s, 17,500lb thrust each	Series -41/42/43: four Rolls-Royce Conway 509s, 17,500lb thrust each	Series -51/52/53: four Pratt & Whitney JT3D-1s or -3Bs, 17,000lb or 18,000lb thrust each; Series -54F/55F: four Pratt & Whitney JT3D-3Bs, 18,000lb thrust each	Series -61: four Pratt & Whitney JT3D-3Bs, 18,000lb thrust each; Series -71: four CFM International CFM-56-2s, 22,000lb thrust each	Series -62: four Pratt & Whitney JT3D-3Bs, 18,000lb thrust each; Series -72: four CFM International CFM-56-2s, 22,000lb thrust each	Series -63: four Pratt & Whitney JT3D-7s, 19,000lb thrust each; Series -73: four CFM International CFM-56-2s, 22,000lb thrust each
DIMENSIONS								
Length:	150ft 7in (45.9m)	150ft 7in (45.9m)	150ft 7in (45.9m)	150ft 7in (45.9m)	150ft 7in (45.9m)	187ft 4in (57.1m)	157ft 4in (47.9m)	187ft 4in (57.1m)
Wingspan:	139ft 7in (42.6m)	142ft 3in (43.4m)	142ft 3in (43.4m)	142ft 3in (43.4m)	142ft 3in (43.4m)	142ft 3in (43.4m)	148ft 4in (45.2m)	148ft 4in (45.2m)
Height:	42ft 3in (12.9m)	42ft 3in (12.9m)	42ft 3in (12.9m)	42ft 3in (12.9m)	42ft 3in (12.9m)	42ft 3in (12.9m)	42ft 3in (12.9m)	42ft 4in (12.9m)
Wing area:	2,758.2 sq ft (256.2 sq m)	2,772.8 sq ft (257.6 sq m)	2,772.8 sq ft (257.6 sq m)	2,772.8 sq ft (257.6 sq m)	2,883.6 sq ft (267.9 sq m)	2,883.6 sq ft (267.9 sq m)	2,926.8 sq ft (271.9 sq m)	2,926.8 sq ft (271.9 sq m)
WEIGHTS								
Max take-off weight:	Series -11: 265,000lb (120,202kg); Series -12: 273,000lb (123,831kg)	Series -20: 276,000lb (125,191kg)	Series -31: 300,000lb (136,078kg); Series -32: 310,000lb (140,614kg); Series -33: 315,000lb (142,882kg)	Series -41: 300,000lb (136,078kg); Series -42: 310,000lb (140,614kg); Series -43: 315,000lb (142,882kg)	Series -51: 276,000lb (125,191kg); Series -52: 300,000lb (136,078kg); Series -53: 310,000lb (140,614kg)	Series -61/71: 325,000lb (127,418kg); Series -61/71F Freighter: 328,000lb (148,778kg)	Series -62/72/72F Freighter: 335,000lb (151,953kg)	Series -63/73: 350,000lb (158,757kg); Series -63CF/PF: 355,000lb (161,025kg)
Max payload:	Series -11/12: 46,103lb (20,912kg)	Series -21: 43,624lb (19,788kg)	Series -31/32/33: 51,870lb (23,528kg)	Series -41/42: 52,000lb (23,587kg); Series -43: 43,691lb (19,818kg)	Series -51/52/53/54/55: 52,000lb (23,587kg)	Series -61: 71,899lb (32,613kg); Series -71: 60,300lb (27,352kg)	Series -62: 51,745lb (23,471kg); Series -72: 41,800lb (18,960kg)	Series -63: 71,262lb (32,324kg); Series -73: 64,800lb (29,393kg)
ACCOMMODATION								
Typical mixed-class:	116	116	132	132	132	220	189	220
PERFORMANCE								
Cruising speed:	556mph (895km/h)	556mph (895km/h)	556mph (895km/h)	556mph (895km/h)	556mph (895km/h)	556mph (895km/h)	556mph (895km/h)	556mph (895km/h)
Range:	Series -11/12: 4,330 miles (6,968km)	Series -21: 4,660 miles (7,500km)	Series -31/32/33: 4,609 miles (7,417km)	Series -41/42/43: 5,450 miles (8,771km)	Series -51/52/53/54: 5,719 miles (9,204km)	Series -61: 3,747 miles (6,030km); Series -71: 4,000 miles (6,437km)	Series -62: 5,995 miles (9,648km); Series -72: 6,100 miles (9,817km)	Series -63: 4,496 miles (7,236km); Series -73: 5,200 miles (8,369km)


DC-8-33
F
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DC-8-62
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DC-8-62
0 metres 5 10 15
0 feet 18 36 54

For an aircraft that wasn't a market leader, the DC-8 notched up an outstanding service career

Delta's DC-8-11 N801E was the aircraft that operated the type's inaugural scheduled service. GETTY

United Air Lines became the first carrier to take delivery of a DC-8 when DC-8-11 N8004U (c/n 45281) *Mainliner Capt RT Freng* was accepted on 3 June 1959. Eager to tout its new *Jet Mainliner* flagship and the company's first foray into the jet age, United embarked on a promotional tour, complete with cabin mock-ups, cutaway models and a movie, *Jet Mainliner Flight 803*, which demonstrated a transcontinental flight from New York to San Francisco. The airline used the first six deliveries for crew and airport training before starting service and even produced a 'Jetarama' mobile display to show the DC-8's interior at airports around the country.

Delta Air Lines followed, another -11, N801E (c/n 45408) *Pride of Delta*, arriving on 22 July 1959. The delivery flight from Long Beach to Miami set a new transcontinental speed record for the route at just four hours 43 minutes. In preparation for its entry into service, Delta ordered 17 airport jet bridges for its Atlanta base.

Both United and Delta — like 707 launch customers Pan American and TWA — took the opportunity to reveal brand-new liveries on their jets, which for Delta saw the first use of its 'widget' logo. They additionally sought to bring fresh standards of luxury and comfort to their cabin interiors.

United enlisted industrial designer Raymond Loewy, who also devised a new crew uniform. The centrepiece was the Red Carpet Room, a first-class lounge — which United claimed was the "largest, most luxurious lounge of any jetliner" — enabling passengers to relax in comfort, with a second lounge area in the coach cabin.

Delta worked with Douglas artists to create a cabin inspired by the sea and sky. A sumptuous 'Delta Imperial' custom carpet in beige with blue highlights ran the length of the cabin, while on the ceiling a fabric called Cosmos depicted the planets and stars on an oyster-white background. In the first-class cabin, seats were covered in ivy-green fabric trimmed with beige leather, the windows adorned with 'sunlight-coloured' curtains. The finishing touch, a brightly coloured mural called 'Goldcoast', was featured on the bulkhead of the forward lounge. The coach cabin featured seats in chartreuse green and gold fabric, trimmed in sage.

Both United and Delta were eager to be first to put the DC-8 into scheduled passenger operation, ultimately launching services on the same day, 18 September 1959. Delta won by a nose due to the three-hour time difference between the east and west coasts. Delta's inaugural DC-8 passenger service, flight 823, left New York's Idlewild airport (now John F. Kennedy International) at 09.20, operated by N801E. It was bound for Atlanta under the command of Capt Floyd Addison with first officer Jack McMahan, second officer Hank Freese, four cabin crew and 119 passengers. The

How N801E appeared at the time it flew the first commercial flight by a DC-8, on 18 September 1959. KEY COLLECTION

The first-class cabin of an early Delta DC-8, created in conjunction with Douglas itself. DELTA AIR LINES

aircraft arrived in Atlanta at 11.00, met by well-wishers and a welcoming ceremony, where Delta founder and president C. E. Woolman stated, "This is a proud occasion for Delta Air Lines. We take deep pride in being the first airline in the world to place the magnificent new Douglas DC-8 in scheduled service."

United's inaugural service departed San Francisco at 08.30 local (11.30 on the eastern seaboard) that same day, bound for New York.

Series -10 (-11/-12)

In February 1960, with a flurry of new variants coming on stream and production reaching the targeted level of eight per month, Douglas adopted a new naming convention for the type, replacing the 'A' ('Domestic') and 'B' ('Overwater') designators. The original JT3C-powered 'Domestic' DC-8 became the -10, although in practice all 28 produced — 22 for United and six for Delta — were designated as -11s following design improvements. The first production DC-8 to be certified for operation was the series -11, with an MGTOW of 265,000lb and capacity for 116 passengers.

Seeking to honour its performance guarantees, a DC-8-11 was fitted with wing slots and extended tips, being recertificated as a -12 with an increased MGTOW of 273,000lb. United and Delta retrofitted their -11s as -12s, and most JT3-powered series -10s were later further upgraded to JT4A-engined DC-8-21s.

Series -20 (-21)

The series -21 took the -10 airframe and added more powerful 15,800lb-thrust JT4A engines, increasing the DC-8's range to 4,100 miles and incorporating adapted pylons and thrust reversers. The variant received its type certificate on 19 January 1960 and Eastern Air Lines, which had amended its original DC-8 order from -10s to -20s and was the first to take delivery of the -21, inaugurated service between New York and Miami the following day. Production of the -21 series ran to 34, most for United, Eastern and National.

Series -30 (-31/-32/-33)

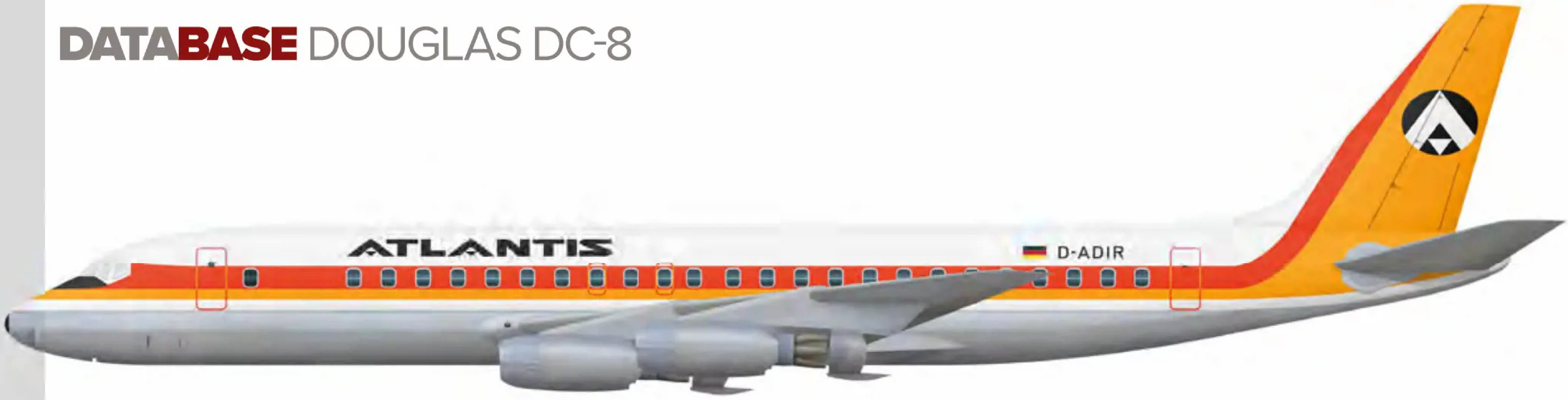
The series -30, ordered by Pan American — the renamed 'Overwater' or 'B' version, with 16,800lb-thrust JT4A-9 engines — was essentially a -20 airframe with a higher MGTOW, additional fuel capacity, uprated engines, wing slots and extended wingtips, taking the range to 4,800 miles.

DATAFILE

ITALIAN STYLE IN THE SKIES

As the jet age progressed and 707s and DC-8s dominated flag-carriers' long-haul fleets, airlines sought to differentiate themselves with unique cabin interiors. Perhaps the most stylish of the era was Alitalia, whose DC-8 cabins, created in 1960 by architect and designer Ignazio Gardella, brought "warm toned colours and materials like leather and wood, nearly creating a club atmosphere". Sidewalls were covered in natural leather, with white ceilings, dark green carpet, seats in darker leather and bulkheads of 'coffee-tinted wood' adorned with Italian works of art by contemporary artists such as Cagli, Guttuso, Marino, Mirko and Santomaso, which could be purchased by passengers. A sign inside the cabin stated, "Contemporary Italian painters join Alitalia for your pleasure and relaxation."

A sprightly departure by Alitalia DC-8-62 I-DIWV *Gioacchino Rossini* from Heathrow in April 1969. DAVID RANSTED COLLECTION



DC-8-33 D-ADIR, an ex-Swissair aeroplane, during its time from 1971-73 with German holiday charter airline Atlantis. CHRIS SANDHAM-BAILEY

PAN AMERICAN
N801PA

Pan American didn't end up using the type for long. DC-8-33 N801PA, at Heathrow in September 1964, was its first, having been one of the aircraft used for flight-testing. KEN FIELDING

The -31 (MGTOW 300,000lb) and -32 (MGTOW 310,000lb) were certificated on 1 February 1960, the latter fitted with additional wing fuel tanks and redesigned flaps that enabled improved cruise performance. Series -30 customers included Japan Air Lines, whose first DC-8 was the first jet airliner operated in Japan, Northwest Orient and Philippine Airlines.

By far the most successful of this variant was the series -33, 42 aircraft serving with Pan Am, KLM, SAS, JAL, Swissair and the two independent long-haul French carriers UAT and TAI. In SAS service the -30 was distinguished by two cabin windows between the flight deck window and the forward passenger door, marking the first-class cabin which featured just two rows of seats.

Pan Am, the first airline to order the DC-8, finally placed the -32 into service on 27 March 1960 between New York and Bermuda. The airline upgraded its aircraft to series -33 after that variant — with 17,500lb-thrust JT4A-11 engines, 315,000lb MGTOW and the earlier wing and flap upgrades — was certificated on 28 November 1960. Production of the -30 ran to 57 units.

Series -40 (-41/-42/-43)

The -40, certificated on 23 March 1960 — less than two months after the -30 — married a -30 airframe to 17,500lb-thrust Rolls-Royce Conway 509 bypass turbofans, with a MGTOW of 300,000lb. It featured a 4 per cent wing leading edge extension which reduced drag and allowed for a small increase in fuel capacity. The Conways were more efficient, quieter and cleaner than the early-production JT3Cs, but US carriers, hesitant to buy from foreign manufacturers and mindful of the improved JT3D and JT4 in the pipeline, shied away. Only 32 of the series -40 were produced, the principal customers being Trans-Canada Air Lines (TCA), Canadian Pacific and Alitalia. BOAC evaluated Conway-powered DC-8s and 707s before settling on the Boeing design.

TCA was the first airline to commence -40 service on 1 April 1960 on the Montreal-Toronto-Vancouver run. Capt Ken Kahn, a former Seaboard World Airlines DC-8 pilot, comments, "TCA wanted to operate its DC-8-40s without

The May 1960 ceremonial christening at London Airport of KLM DC-8-33 PH-DCC as *Sir Frank Whittle*, attended by the jet engine pioneer himself. *AEROPLANE*

Finnish charter carrier Spear Air flew DC-8-32 N7181C from 1972, reregistering it as OH-SOB. The aircraft had flown with Northwest and National and later served with Overseas National. DAVID RANSTED COLLECTION

A pre-delivery test flight by a Trans-Canada Air Lines DC-8-42. AIR CANADA

flight engineers. They were built with some of the flight engineer’s controls and instrumentation on the extended lower part of the centre instrument panel. The co-pilot was expected to slide his seat back to operate what remained at the FE position. It was a bad idea and never implemented”. Three -40s were later modified to series -50.

Series -50 (-51/-52/-53/-54/-55)

The series -50 was the first variant to employ the more powerful, quieter JT3D turbofan and incorporated the previous improvements, bringing a much-needed boost to the aircraft’s range and take-off power — initially providing a MGTOW of 276,000lb — and closing the performance gap to the 707. The first -50, the converted ‘Ship 1,’ flew on 20 December 1960. Early customers included United and National, and foreign buyers KLM, Iberia, Aeronaves de México and Philippine Airlines.

As with earlier variants, the series -50 saw incremental performance gains, the -52 and -53 increasing power from 17,000lb to 18,000lb and achieving MGTOWs of 300,000lb (later 305,000lb) and 315,000lb respectively. In high-density configuration the -50 could accommodate 176 passengers, later upped to 189.

A development of the series -50 was the -54F Jet Trader, a combined passenger/cargo airliner with a forward cargo door of 140 by 80in with passengers accommodated in the rear cabin, alternatively in an all-passenger or all-cargo configuration. The Jet Trader, powered by 18,000lb-thrust JT3D-3Bs, featured a reinforced floor, pallet handling system, cargo barrier netting and strengthened undercarriage, allowing an MGTOW of 315,000lb, as well as brake and spoiler improvements that reduced landing distance. Launch customers were

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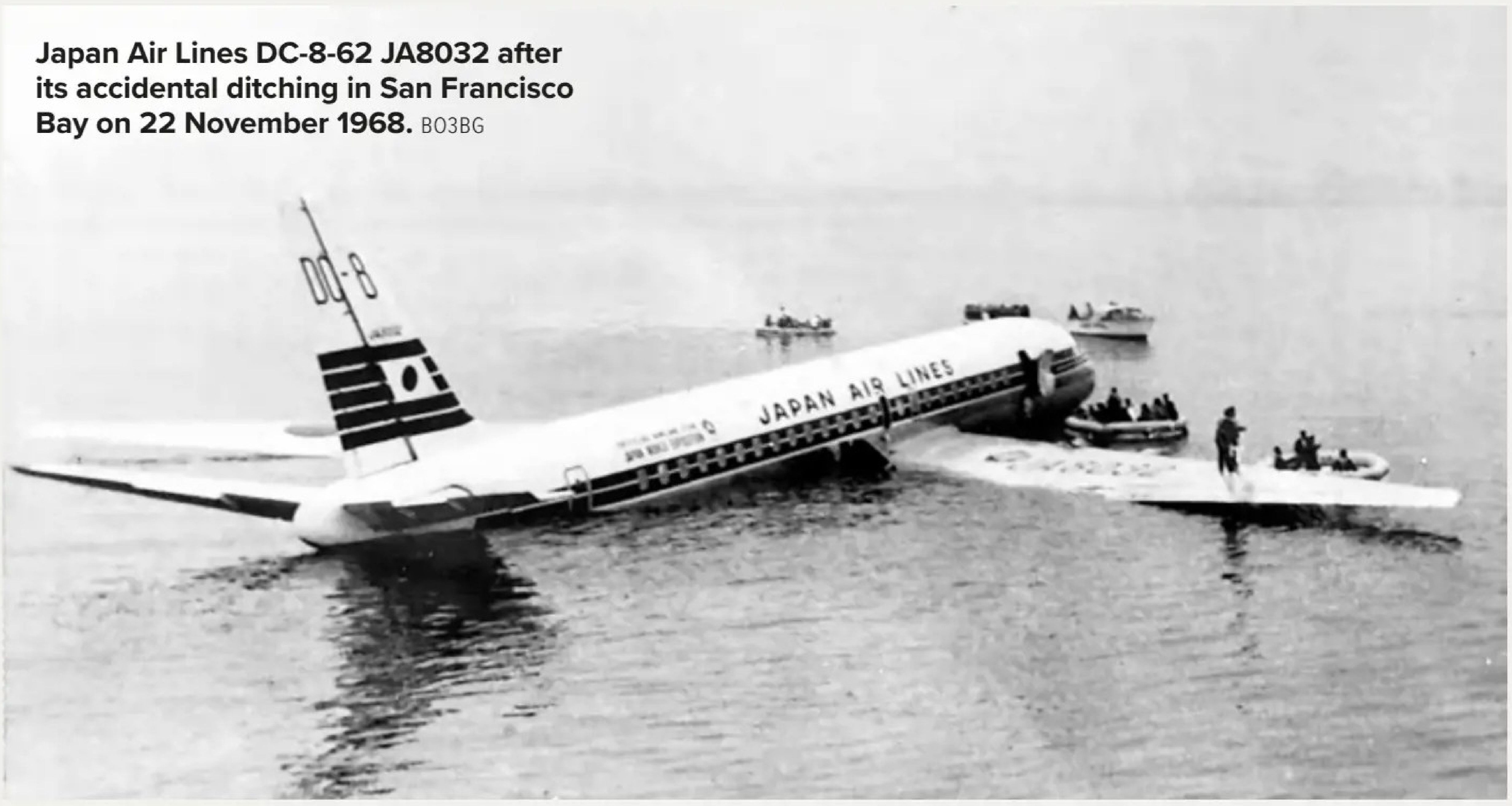
DATAFILE

SAFETY RECORD: A MIXED BAG

In common with other first-generation jet airliners, the DC-8 suffered a higher accident attrition rate than modern aircraft. While more than 80 DC-8s were lost in accidents, few were attributed to the aircraft’s design or construction, although a 1961 fatal crash of a United aircraft in Denver was caused by the failure of the two port-engine thrust reversers on landing, while the crash five years later of an Air New Zealand training flight in Auckland resulted from the uncommanded engagement of a reverser due to a design fault. Brake issues were thought to be involved in a fatal accident at Anchorage in 1970, and a failure of the elevator and gust lock was found responsible for a crash on take-off from Tokyo in 1977. Ground spoiler deployment while airborne resulted in a tragic crash at Toronto in 1970, and care had to be taken on approach when arming the spoiler lever to ensure it didn’t move aft and engage in flight.



Japan Air Lines DC-8-62 JA8032 after its accidental ditching in San Francisco Bay on 22 November 1968. BO3BG

The DC-8’s inherent toughness is underlined by an incident in November 1968 in which a JAL aircraft, registration JA8032, landed short of the runway in San Francisco Bay. Following its immersion in salt water, the airframe was recovered and repaired and went on to serve for another 15 years.

TCA for the combi version and United for the all-cargo variant. Some airlines, such as KLM and JAL, opted for the all-passenger derivative, with a higher MGTOW of 325,000lb, which became the series -55.

In its cargo configuration, with a payload of 96,000lb, the DC-8-54F — and subsequent -55F — proved an excellent freight-hauler. During its later years many examples were found carrying freight in Africa, the Middle East and Latin America. Capt Jon Ludgater, who flew the -55F for Affretair, recalls, "Operating in these often primitive environments, its simplicity and reliability were a huge advantage. The one thing we could have done with was an APU [auxiliary power unit] although we would sometimes have a jet start cart on the forward pallet position exhausting through the open cargo door."

Seaboard World's DC-8-55Fs had a system to side-step the lack of an APU, as Capt Ken Kahn explains: "There was a reservoir of compressed air inside the right main landing gear. The 24-volt, 22 ampere-hour aircraft battery was only used to open the necessary valve(s) and fire the igniters for the number three engine. Fuel was fed by gravity. There was only enough air for one try. If the start was successful, the number three engine supplied electric power and bleed air to start the other engines. There was a compressor in the wheel well that pressurised the reservoir in flight. The DC-8-63CFs had a separate air tank in the right-hand wheel-well. There was no on-board compressor and it was serviced by ground personnel."

From mid-1961, with the array of design and performance improvements becoming standard on new models, production was concentrated on the series -40 and -50 variants.

'Super Sixties'

Throughout the post-war years Douglas proved adept at stretching and developing its designs, spurred by its rivalry with Lockheed, with constant improvements to its DC-6 and DC-7 designs versus Lockheed's Constellation. This experience proved of immense value to the DC-8 programme in building in design capacity for future development. Douglas had planned potential fuselage stretch into the original design: its 30° wing sweep and tall main undercarriage enabled a fuselage extension, allowing for fuselage ground clearance on take-off and landing, while retaining the existing wingspan, empennage and undercarriage. The lengthened airframe was strengthened through beefed-up longerons and increased fuselage skin gauge.

Douglas began evaluating a stretch of the DC-8's fuselage in the early 1960s and during April 1965 the company announced three new variants, the 'Super Sixties'. Production of the DC-8 had fallen behind the 707 but these models breathed life into the programme, eventually almost doubling the DC-8's production run.

Series -61

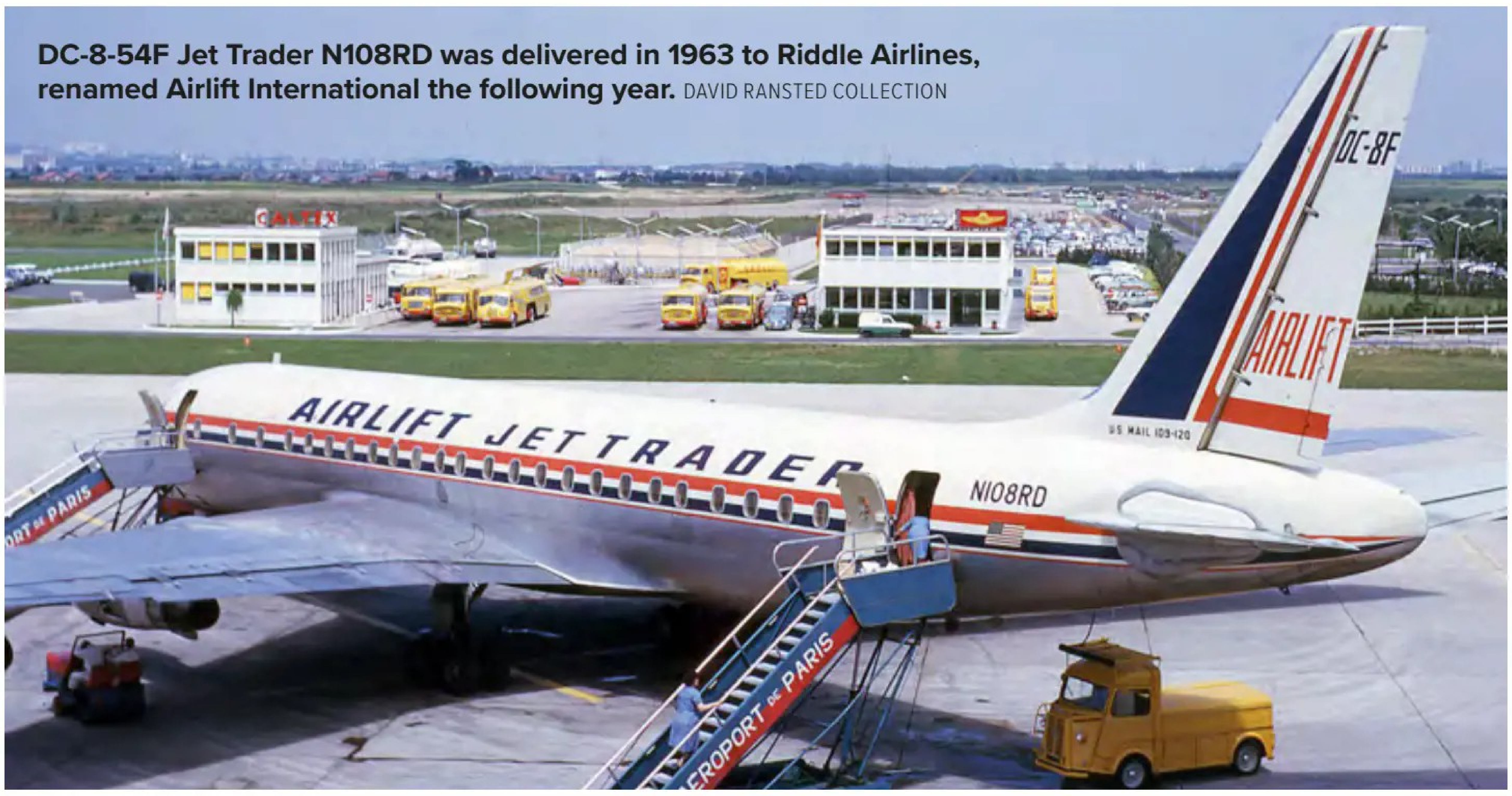
The ultimate fuselage stretch came with the DC-8-61 and -63, which could seat 220 passengers in mixed-class configuration or a maximum of 251 in a single class with 34in seat pitch, later increased to 269. These were the largest commercial jet airliners until the Boeing 747 entered service in 1970. Douglas added 37ft to the length through two plugs inserted in the fuselage — 200in forward of the wing and 240in aft of the wing — taking it to 187ft 4in.

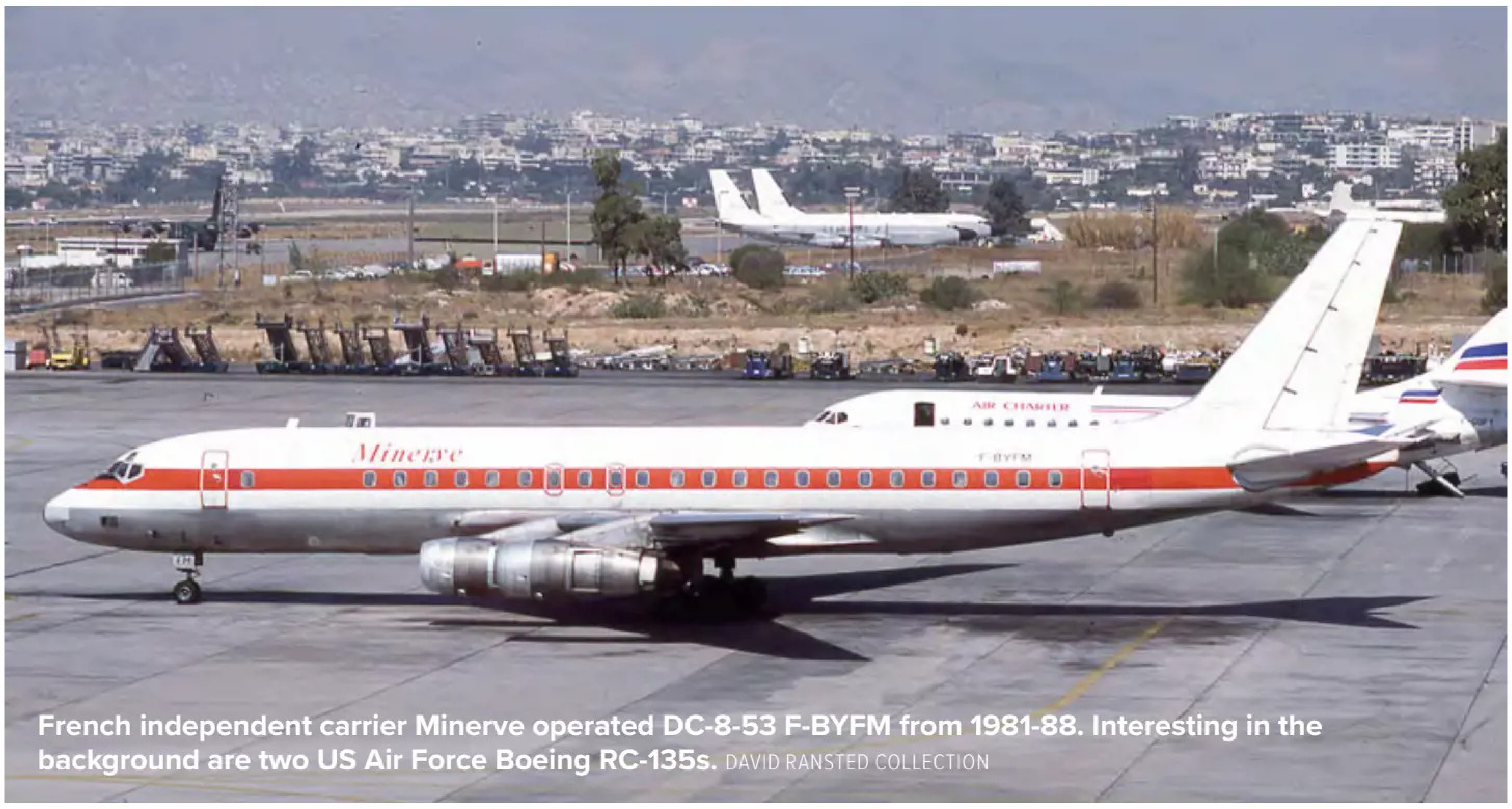
The -61 featured redesigned 'cut-back' engine pylons and 'flow-through' nacelles for improved aerodynamic performance, reducing drag by 5 per cent. Powered by 19,000lb-thrust JT3D-3B turbofans, it all resulted in a maximum range of 3,747 miles.

The first flight of the -61 took place on 14 March 1966 and it entered service with United Airlines on 25 February 1967 between Los Angeles and Honolulu.

Series -62

The DC-8-62 had a fuselage of 155ft, with 40in plugs fore and aft of the wing, being 7ft longer and with a 3ft greater wingspan to improve its aerodynamics over the series -30. It offered


DC-8-54F Jet Trader N108RD was delivered in 1963 to Riddle Airlines, renamed Airlift International the following year. DAVID RANSTED COLLECTION


French independent carrier Minerve operated DC-8-53 F-BYFM from 1981-88. Interesting in the background are two US Air Force Boeing RC-135s. DAVID RANSTED COLLECTION

United Airlines DC-8-61 N8096U powers out of Los Angeles during 1974. The aircraft joined United in May 1969 and was converted to a -71 in 1983, leaving the fleet in 1990. DAVID RANSTED COLLECTION

exceptional transcontinental capability with a range of 5,995 miles, typically seating up to 189 passengers.

Powered by JT3B-3B turbofans, it incorporated many of the fuselage improvements of the series -61 and featured redesigned engine pods and pylons for reduced drag, enabling an increased MGTOW of 335,000lb, lengthened leading-edge slots and a blending of main and secondary exhausts which lessened noise.

The variant first flew on 29 August 1966, received its certificate of airworthiness on 27 April 1967 and entered service with SAS on 22 May from Copenhagen to New York. SAS employed the -62 on its trans-polar route between Copenhagen and the US west coast and on its Trans-Asian Express flights to the Far East, while United put the variant into use non-stop between New York and Honolulu.

Series -63

Billed as 'the ultimate DC-8', the -63 took the fuselage of the -61 and the wing and engine pods of the -62, being powered by 19,000lb-thrust JT3B-7 engines. With an MGTOW of 355,000lb — 90,000lb greater than the figure for the original -10 — the -63 had a range of 4,496 miles with a passenger capacity of 269 in a high-density cabin layout. The DC-8-63 entered service with KLM on 27 July 1967. Douglas additionally developed the -63CF and -63PF combi and pure freighter versions, the latter being bestowed with a strengthened wing and beefed-up landing gear.

The stretch of the DC-8 not only created a highly efficient and profitable airliner. Its increased size helped bridge the gap between long-haul narrow-body airliners and the wide-body aircraft that ushered in the mass transit era in the early 1970s, proving less of a shock to airlines' yields, seat factors and balance sheets.

The economics of the series -61 and -63 DC-8s proved ideal for America's 'non-sked' (non-scheduled or 'supplemental') charter carriers in an all-economy configuration or as a freighter, the aircraft becoming a money-maker for World Airways, Trans International Airlines, Overseas National Airways, Capitol International, Saturn Airways and American Flyers Airline. Its cavernous 2,500-cubic foot cargo capacity additionally gained favour with Seaboard World, Flying Tiger Line, Zantop and Airlift International, and the type proved ideal for US Air Force Military Airlift Command charters. In addition to its passenger charters, Trans International cultivated a lucrative specialist niche carrying racehorses and livestock. Among foreign buyers the stretched DC-8 became a long-haul and transcontinental workhorse, customers including Air Canada, Canadian Pacific,

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> ***"The stretch created an efficient airliner"***

The Peruvian Air Force bought two DC-8-62CFs for transport duties in 1982-83. KEY COLLECTION

DATAFILE

THE US MILITARY'S DC-8s

In 1968 the US Air Force issued a requirement for an updated AWACS (airborne early warning and control system) capability. Douglas answered the call with a proposal based on the DC-8-62, constructing a full-size mock-up complete with a 35ft-diameter rotodome. The contract again went to Boeing, for what became the E-3 Sentry.

However, just one DC-8 saw service with the US military. A 1966-vintage former United Air Lines DC-8-54F (N8048U, c/n 45881) was employed by the US Navy — designated as an EC-24A, with serial BuNo 163050 — as an electronic warfare training 'aggressor' platform. It served the Fleet Electronic Warfare Support Group between 1987 and 1998.

The US Navy's unique EC-24A, BuNo 163050, served with the Fleet Electronic Warfare Support Group. During September 1993 it made a very rare visit to RNAS Yeovilton. AVIATION PHOTO COMPANY

SURINAM AIRWAYS

The very striking livery of Surinam Airways on DC-8-63 N4925C, which was with the carrier between 1985 and 1992. DAVID RANSTED COLLECTION

KLM, JAL, SAS, Iberia, Loftleiðir, UTA and VIASA.

The final iteration of the original DC-8 was the high-performance -63PF, incorporating the higher gross weight and strengthened undercarriage and cargo floor of the freighters but without a cargo door, although this variant was ordered only by Eastern Airlines.

Ending

While the DC-8 programme received a major boost from the advent of the 'Super Sixty' series, the research, development and production costs incurred from successive versions of the DC-8 (and, indeed, the DC-9), development expenditure for the new wide-body DC-10 and the lingering effects from cost over-runs and late-delivery and performance shortfall penalty payments from the early days of the DC-8 brought cashflow issues for Douglas in the second half of the 1960s. A merger offer was received from the McDonnell Aircraft Corporation, a good fit for Douglas as McDonnell was almost exclusively a defence contractor, and the two merged on 28 April 1967.

By the end of the 1960s DC-8 orders dwindled sharply and production was decreased as McDonnell Douglas focused its efforts on the DC-10. Although the company was anxious to clear the decks for the DC-10, with DC-8 manufacturing reduced to one per month in 1971, its sales team made a final push for orders before closing the line. The final aircraft — 'Ship 556' — was delivered to SAS on 17 May 1972. Of this total, 262 aircraft were 'Super Sixties'.

After production ended Douglas immediately dismantled the manufacturing jigs, making any reprieve impossible, although a few operators made too-late requests for more aircraft. Some airlines managed to keep their DC-8 interiors appearing fresh and up-to-date with a wide-body look and by replacing the original luggage racks with enclosed overhead lockers.

Leases of life

In response to growing public discontent with aircraft noise, General Electric began discussions with airlines during 1975 over the potential marriage of its new, quieter and more fuel-efficient high-bypass CFM-56 turbofan engine — developed with its French partner Snecma — for use on both the DC-8 and 707. Douglas, after a protracted period of negotiation, was persuaded to come on board in the late 1970s, leading to conversions of its 'Super Sixties' into the DC-8-71, -72 and -73.

The CFM-56, delivering a derated 22,000lb of thrust, required new pylons and nacelles designed by Grumman Aerospace. Conversions were carried out at Douglas's facility in Tulsa, Oklahoma by Cammacorp, a company founded by former Douglas president Jack McGowan.

The series -70 was 70 per cent quieter than the -60 and, when it entered service, the quietest four-engined jet airliner. The new engines boasted 23 per cent greater fuel-efficiency over the JT3Ds and provided longer range but, while the aircraft retained their original MGTOW, the heavier engines meant maximum payload was slightly reduced. Conversion of the -61 to the -71 was more complex than on the -62/-72 or -63/-73 because the -61 had not been modified with the improved wing and relocated engines fitted to the -62 and -63.

Certification was awarded to the series -71/72/73 in 1982 and over the following six years 110 DC-8s were converted for 19 operators, with original launch

EMERY WORLDWIDE

Emery Worldwide Airlines had an extensive DC-8 freighter fleet, from which this is DC-8-71F N8177U. KEY COLLECTION

Samaritan's Purse
INTERNATIONAL RELIEF

A 2021 visit to the NASA Armstrong Flight Research Center at Palmdale, California by the Samaritan's Purse DC-8-72CF, delivering supplies for an emergency field hospital being constructed in nearby Lancaster to support COVID-19 patients. USAF

While Skybus Jet Cargo of Peru still owns two DC-8-73CFs, this one, OB-2158-P, has not been active since April 2023. ALAMY

customers United and Delta operating large fleets of them. Delta's last DC-8 flight was on 1 May 1989, from Baltimore/Washington International to Atlanta. The final United DC-8 service took place on 31 October 1991, between San Francisco and Kona, Hawaii.

In the past few years just a handful of DC-8s remained in service. NASA had a DC-8-72 flying laboratory, used from 1986 for scientific and meteorological and oceanographic research and based at its Armstrong Flight Research Center in Palmdale, California, until its well-earned retirement in 2024. Samaritan's Purse, a humanitarian relief organisation in the USA, continues to use a -72 Combi, N782SP (c/n 46013), originally delivered to Finnair in 1969. It is set for retirement at the end of 2025. A pair of -73CFs are still on the strength of Peruvian freight charter operator Skybus Jet Cargo, of which OB-2231-P, supplied to Air Canada during 1970, remains active.

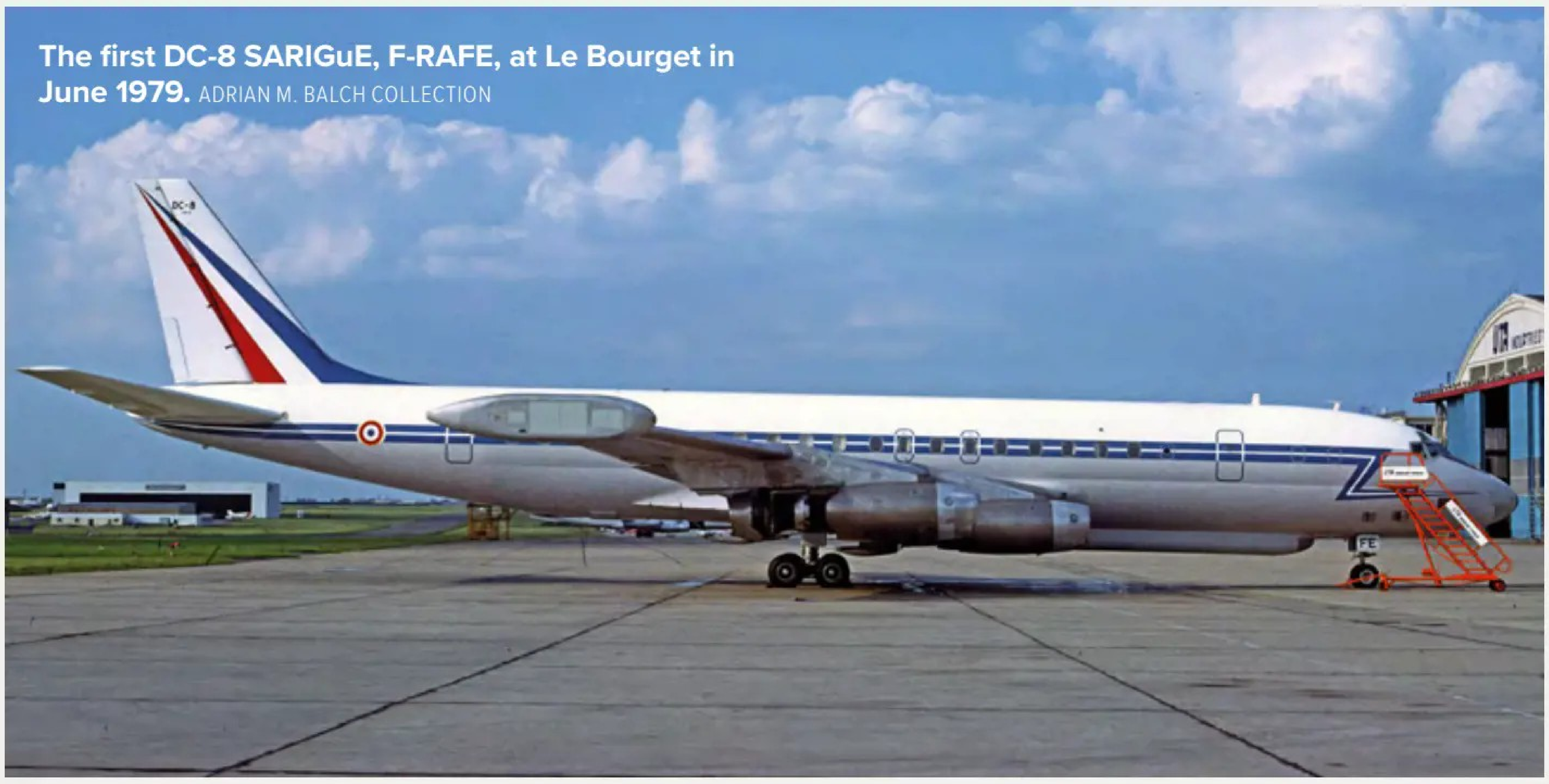
DATAFILE

FRANCE'S TRANSPORT AND SIGINT FLEET

While several air arms have operated second-hand DC-8s, primarily in a VIP configuration, the type's most notable military service was with France's Armée de l'Air. It took delivery of its first example, a DC-8-55F, for its VIP transport squadron — the Groupe de Liaisons Aériennes Ministérielles, or GLAM — in January 1966. Given the military registration F-RAFA, it was c/n 45820.

The unit became Escadron de Transport 3/60 during 1968, and it received two further -55Fs, an ex-Seaboard World aircraft in 1969 (F-RAFB, c/n 45692) and one from UTA in 1972 (F-RAFC, c/n 45819). Following them in 1976 came a -62CF, c/n 46043, formerly operated by Finnair; it became F-RAFD. Aside from carrying government ministers and officials, the DC-8s — based initially at Le Bourget and then Paris Charles de Gaulle — regularly supported France's overseas military commitments in the transport role, not least its Pacific nuclear tests and units stationed in African territories, and conducted humanitarian aid missions.

Two more -62CFs, also from Finnair, followed during 1981. It was the second of these, F-RAFG (c/n 46130), which spearheaded the Armée de l'Air's DC-8 re-engining programme the following year. CFM-56s were fitted by UTA at Le Bourget, and it flew again as a DC-8-72CF in August 1982. The air force's first -62CF, F-RAFD, underwent the same powerplant upgrade in 1983, after which both -72CFs were exclusively assigned to nuclear test support missions. With 128 seats and a two-ton equipment pallet, the aircraft could now fly from France to Polynesia with just one stop rather than two. A third CFM-56-powered aircraft became available in April 1984 when F-RAFF (c/n 46130), first of the 1981 acquisitions, emerged from conversion. With this, the DC-8-55s could gradually be retired, F-RAFB, 'FA and 'FC leaving the fleet in 1983, 1988 and 1998 respectively.



The first DC-8 SARIGuE, F-RAFE, at Le Bourget in June 1979. ADRIAN M. BALCH COLLECTION

Aside from the transports, a DC-8-33 acquired from UTA, c/n 45570, was modified to SARIGuE (Système Aéroporté de Recueil des Informations de Guerre Électronique) standard as a signals intelligence-gathering platform, entering service as F-RAFE after three years of tests in 1976 with Escadron Électronique 51, then stationed at Brétigny but soon to move to Évreux. It was distinguishable chiefly through its 10m-long ventral radome and wingtip-mounted fairings. An upgrade to -53 standard, with JT3D engines, followed at the start of the next decade. Following its extensive activities during the Cold War, it operated during the 1991 Gulf campaign and subsequent conflicts in the Balkans.

Hitherto on the strength of ET 3/60, DC-8-72CF F-RAFD was converted in 1995 to gradually supplant the existing SARIGuE machine. After the first was retired during 2001, the second — dubbed the SARIGuE-NG — continued for another three years. It was flown from EE 51's home at Évreux to storage at Châteaudun on 17 September 2004.

There was a need for more modern equipment to take over from the -72CF transport models too, and with the procurement of Airbus A310s and A340s the end of the Douglas product in French service was nigh. A retirement ceremony for F-RAFF and 'FG was held on 24 November 2004, bringing to a close — with 238,434 flying hours in the books across the non-SARIGuE fleet — the career of an aircraft that had ushered the Armée de l'Air transport force into the jet era.

Ben Dunnell

A “great jet to fly”, or one with “really bad handling”? DC-8 veterans are still divided...

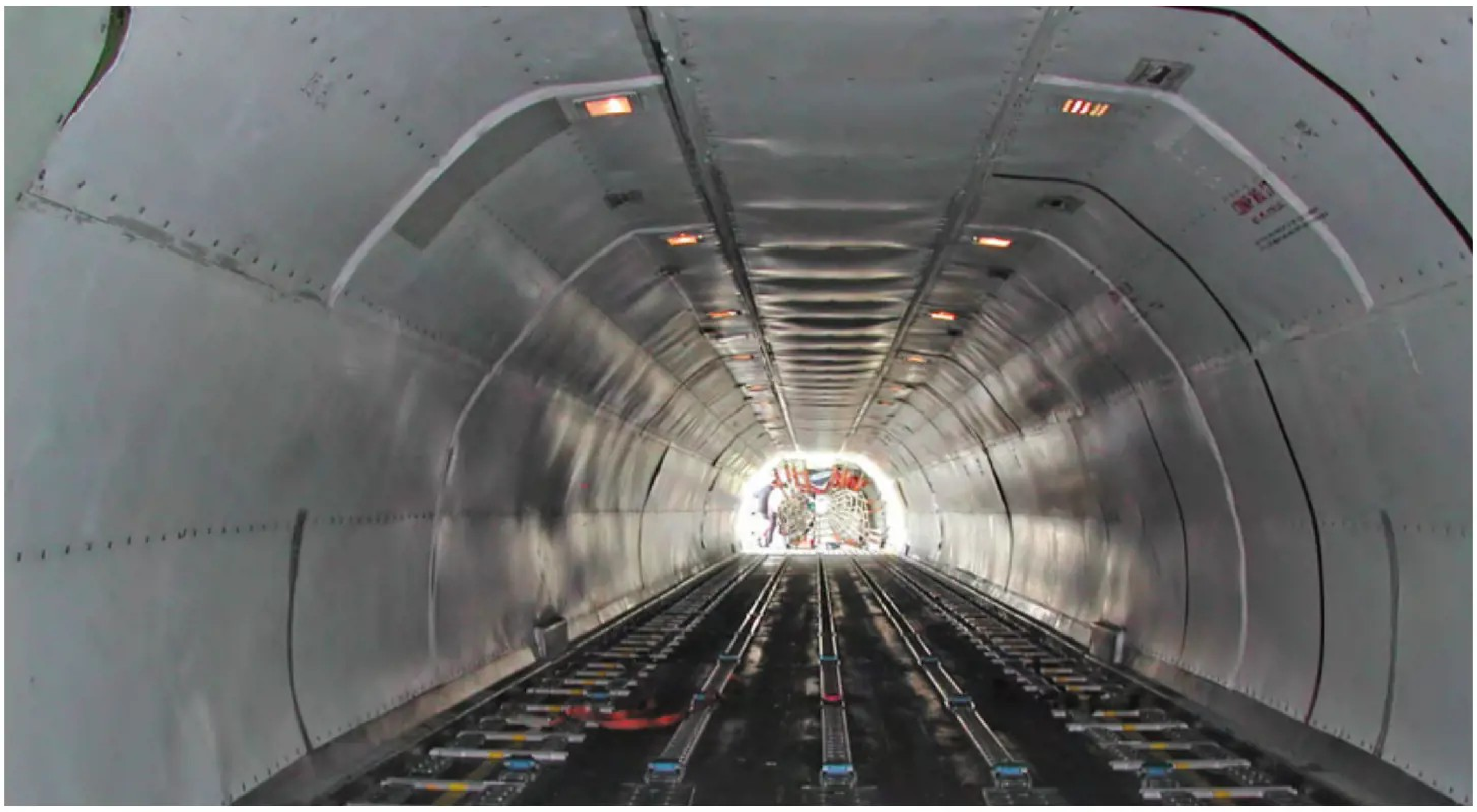
FLYING TIGER Jumbo Jet
TIGERS
N779FT
DC 8 63F

What a superb sight Flying Tiger Line’s DC-8-63CF N779FT made. GETTY

By the time of the final iteration of the DC-8 programme in the form of the -63, the aircraft’s avionics and performance had been transformed, and pilots have remarked on the contrast with earlier models. Capt John Reid-Rowland recalls the -55F’s take-off performance out of Nairobi, the archetypal ‘hot and high’ port of call: “We were always at the maximum take-off weight when departing Nairobi at 2am with our loads of fruit and vegetables for the supermarkets in the UK. On paper, there was no problem in getting airborne, even assuming an engine failure at V1. In practice, with all engines operating, we got uncomfortably close to the red lights at the far end of the runway before staggering into the air. This was also the case at our refuelling stop of Aswan, where the temperatures could be in the high 30s even in the early hours of the morning.”

Capt Dave Shirley says, “On the DC-8-63 series the controls were ‘heavy’, heavier than the -55 series, but the -63 series were extremely stable. You had to be extremely careful to not rotate too ‘nose-up’ or you’d suffer a tail-strike. It was a very long aircraft!” Reid-Rowland agrees: “the -63 was of course longer and required careful rotation to avoid tail-strikes: 9° pitch-up saw you leave the ground and after that you could fly whatever pitch attitude was necessary. People used to rotate very gingerly and thereby used up too much runway”. Former Seaboard World DC-8 pilot Capt Hank Treger adds, “You had to watch your rotation pitch angle speed or you could hit the tail. There was a 2ft-long cartridge in a skid under the tail for over-rotation that could easily be replaced.”

While there is a wide consensus among DC-8 pilots that the aircraft was a reliable and sturdy machine, opinions of its handling characteristics naturally vary. Shirley flew series -55 freighters for Affretair and MK Airlines, largely out of Africa to the UK and Europe and into the Middle East, often on humanitarian missions. He states, “It was a great jet to fly, responsive, extremely stable, very strong — built like a tank! — and forgiving, especially in turbulence or foul weather. What really



The interior of MK’s DC-8-63CF N815CK. The stretched DC-8 had a cargo capacity of 2,500 cubic feet. VIA JOHN REID-ROWLAND

AIRLINES
MK
9G-MKA

DC-8-55F 9G-MKA was an early acquisition by MK Airlines. M. SEDY

stands out in my mind was how reliable the aircraft was and how our flight engineers and 'flying spanners' could always 'fix' a technical problem in the field. On one occasion, after landing in Baghdad during Operation 'Desert Storm', a fuel line had ruptured, and I remember the flight engineer successfully repairing this on the ground with minimal tools available. However, this repair had caused a problem with the operation of the power levers, and the FE had to assist us pilots setting power for the faulty engine during take-off — by using a pair of pliers and setting the power for us!"

Capt Jon Ludgater, who had previously flown Canadair CL-44s and captained the DC-8 with Affretair, concurs: "A real 'gentleman's aerial carriage' from my point of view — it was a revelation in handling comfort and system redundancy. One could comfortably handle it with no hydraulics at all given that braking was then limited to the accumulator and back-up air braking system on landing... Gross weight of our aircraft from memory was 147.4 tons. The weight of fuel and freight could be more than the weight of the airframe, the only jet transport I have flown that could do this. No in-flight spoilers — one used the inboard reversers, not good for tailplane life but you could generate 15,000ft a minute in descent if needed."

> **"It handled like a truck and was built like one"**

Capt David O. Hill flew the stretched DC-8 for Seaboard World and Flying Tigers, later piloting the Boeing 727, DC-10 and 747. He demurs: "It flew like a truck: it had really bad handling, although the guys who'd never flown another jet all loved it. You'd turn the wheel and wait for what seemed like a few seconds and then it would start turning. It was very unresponsive. It was noisy too."

Fellow Seaboard World pilot Capt Ken Kahn agrees: "It handled like a truck, and was built like one. It was noisy due to poor streamlining

SEABOARD WORLD
SWI

Was there ever a better-looking DC-8 livery than that of Seaboard World Airlines, as shown here by DC-8-55CF N802SW? KEY COLLECTION

GENSTAR
TANPER
TEL. 25
airco
TOYOTA

A load about to go aboard MK Airlines' DC-8-55F 9G-MKC during a stop in Tanzania.
VIA JOHN REID-ROWLAND

around the five flat sections of the windshield and due to air leaks around cockpit-side windows caused by damaged seals resulting from our frequently opening them on the ground, since DC-8s did not have APUs and therefore no air conditioning on the ground, and also due to the four turbo-compressors mounted under the cockpit floor". While critical of the DC-8's "relatively poor stopping ability on wet runways", Kahn concludes, "Despite all that, I have great affection for the DC-8 — nothing important hardly ever broke."

Despite its forgiving nature, the DC-8 had its faults and idiosyncrasies. Dave Shirley recalls, "What stands out are how complicated the hydraulic malfunctions were from a pilot's perspective, how the thrust reversers often had problems, and how cabin pressurisation had to be carefully managed with certain types of freight. The outflow valve [OV] had to be cycled manually by the FE during the cruise when certain cargo was carried, such as pineapples. Pineapples have a high water content, and the water would freeze the OV and it wouldn't control the cabin pressure automatically. So, the FE had to monitor the cabin pressure and OV carefully. I remember having to carry out an emergency descent inbound for Europe from Africa due to a loss of cabin pressure for this very reason. We had collected a full load of pineapples out of Accra and the OV froze and we lost cabin pressure leaving Africa. We soon recovered the pressure and control of the OV and continued on our way."

> ***"I have great affection for the DC-8"***

Ludgater recalls another quirk of the design: "Rain removal was a slot at the base of the windscreen and air from the pneumatic system blew water off the flat glass panes. It worked well but the -55 series I flew had pneumatic thrust reverser actuation, so when landing in rain one had a patch where you could not see well due to the low pressure as the reversers were deployed. Then once you could spool one engine up, all became clear. This was resolved in the -60 series with hydraulic thrust actuators, *very* noisy when in use!"

Complaints about the levels of cockpit noise in the DC-8 were notably common: Ludgater explains, "The flight deck seemed quiet but below it were the four cabin turbo-compressors that provided air for pressurisation, like a large turbocharger fed by the pneumatic system, so no bleed air from the engines entered the cabin. They ran at 10 times the flight altitude in tens of thousands of feet, so 30,000rpm at 30,000ft. This proved to be a bad idea for the hearing of the crews."

Reid-Rowland adds, "There was a procedure the FE had to carry out while taxiing out — bleeding the system to purge air from the pipes. If not done correctly, this could result in the outboard engines flaming out before you got to the take-off point. This could be very embarrassing, especially if another aircraft was following you."

Slowing down the DC-8 caused flight crews some anxiety. "The wing spoilers could not be used in flight", says Reid-Rowland, "unlike those on most other jets. They only operated when the landing gear was down and assisted with roll control at low air speeds, as well as deploying on wheel spin-up after landing.

"Because the spoilers could not be used in flight, another method had to be used to increase the rate of descent without increasing forward air speed: the use of thrust reversers in flight. This was effective but caused a great deal of buffeting and vibration and one sometimes wondered about the stresses on the engine pylons. The -55 series thrust reverse system was pneumatically operated and the 'Venetian blind' system was not very reliable, in that the system did not necessarily close properly when cancelling reverse. That was a problem the engineers could easily sort out on the ground when reverse was used after landing but in flight it was a concern. We had to

Many DC-8s gained a new lease of life in their twilight years as freight-haulers, giving faithful service well into the 21st century. MK Airlines, for instance, only retired the type in 2006.
VIA JOHN REID-ROWLAND

use in-flight reverse frequently when flying into Aswan, in southern Egypt, from Nairobi. The -62s and -63s had a far better thrust-reverse system and it was no problem to use in flight — other than the buffeting."

DC-8 versus 707

While the DC-8 is remembered by pilots for its robustness and strength, views on its performance, avionics and handling versus the 707 are mixed. Capt John Reid-Rowland, who flew both types in both cargo and passenger operation, comments, "The DC-8's flight deck was a great deal roomier than the 707's. It was easier for the pilots to get into and out of their seats and there was plenty of room for a flight bag beside the seat.

"The DC-8 was far more mechanical in the operations of its systems: For example, the levers that controlled the fuel valves were connected to the valves by cables. The 707 used electrically controlled switches. Another lever, near the left side of the FE's panel, could be used to directly control the opening and closing of the outflow valve of the pressurisation system. It was referred to as the lollipop lever, as that is what it resembled. In normal operation the outflow valve was controlled electrically, but in unusual situations, or in the event of failure of the electrical control, the FE could control the pressurisation with the lever. One time when he had to do so was during a very rapid descent, a plunge from flight level 410 with all four engines in reverse.

"The DC-8's electrical system was easier than the 707's, in particular when it came to 'parallelling' the generators to connect them to the busbar. On the 707 this was a fairly involved procedure, where the FE had to adjust the frequency of each generator individually to match the others before closing the tie breaker switch. The DC-8's generators were paralleled simply by pressing a button."

While it was simpler than the 707 in some areas, the DC-8 was more complex in others. "I found the fuel system of the DC-8 very complicated compared to the 707's", comments Reid-Rowland. "It was operated with a system of levers and switches on the FE's panel and to me was not intuitive. One thing you could do was transfer fuel from one tank to another to achieve lateral balance — something that wasn't necessary on the 707s, where you could feed any engine from any tank.

"The DC-8 was certainly a more solid aircraft than the 707, with fairly rigid wings; the 707's flexed quite a lot. Handling felt firmer and I found it harder to land the DC-8 smoothly than the 707. Otherwise, performance was similar: cruise at Mach .80 and fuel burn similar — obviously, I suppose, having the same engines!"

Legacy

In 1967, when 'Super Sixty' development and production was gearing up, Douglas had a cumulative loss on the DC-8 programme exceeding $400 million, but by the time of the final DC-8 delivery in 1972 cumulative losses had been brought down to $50 million, and as of 1980 revenue from customer support and spares had generated pre-tax earnings on the total programme of more than $200 million.

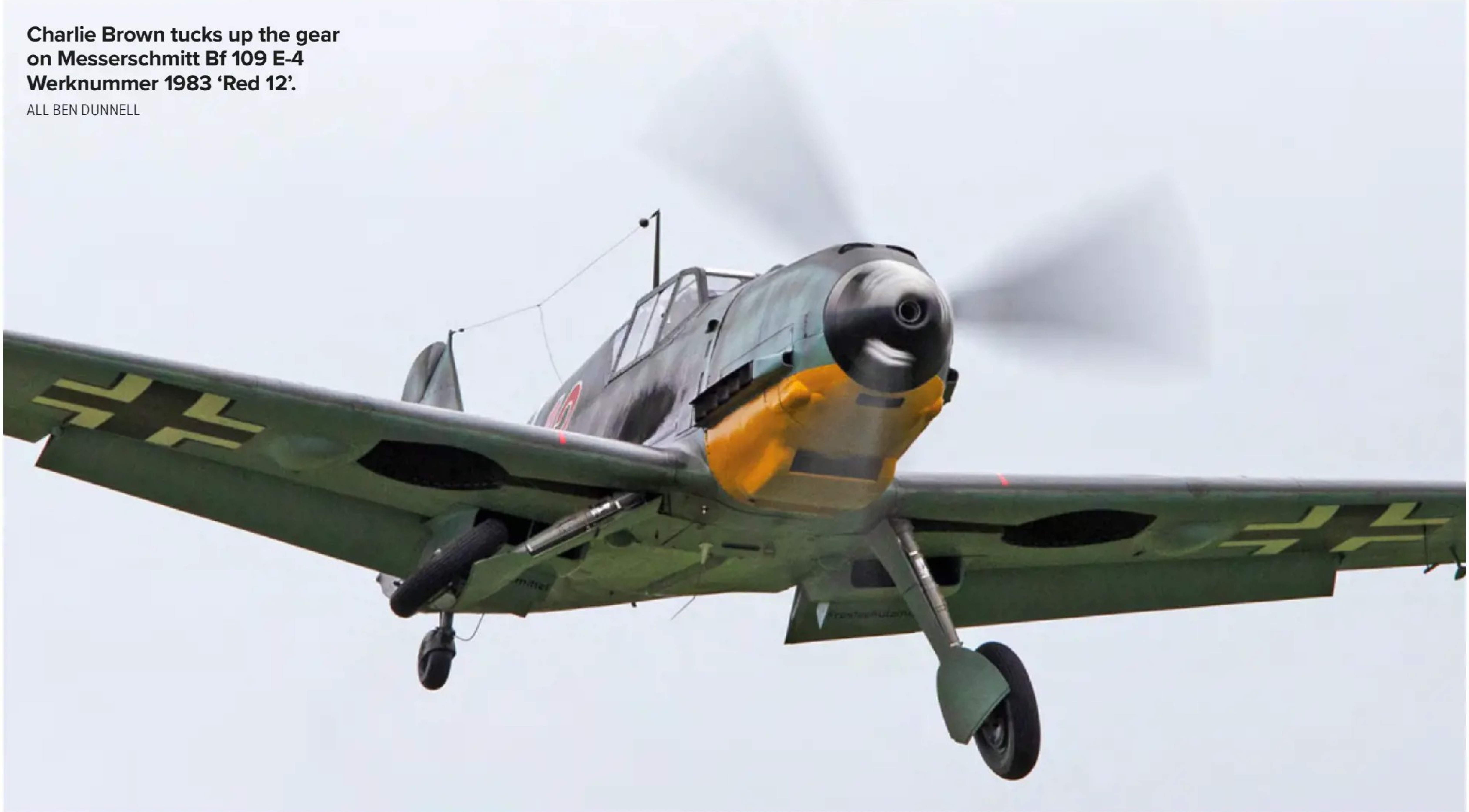
While Boeing's 707 and 720 outsold the DC-8 by almost two-to-one — 1,010 (856 Boeing 707s and 154 Boeing 720s) to 556 — both Douglas and Boeing were able to build on their success and dominance with the long-haul jets to develop families of aircraft that would encourage customer loyalty, Douglas with the DC-9 and Boeing with the 727 and 737 for short/medium-haul operation, leading on to wide-body success with the DC-10 and 747.

McDonnell Douglas's preference for improving existing designs rather than launching clean-sheet models would ultimately weaken its customer appeal and performance, and the company was taken over by Boeing in 1997. Nevertheless, the robust and versatile DC-8 has served in freighter and specialist roles well into the 21st century, a tribute to the foresight and creativity of its designers.

The author thanks DC-8 pilots David O. Hill, Dave Bryson, Jon Ludgater, Dave Shirley, John Reid-Rowland, Jeremy Boyd, Ken Kahn and Hank Treger.

Oldtimer Fliegertreffen Hahnweide

12-14 SEPT



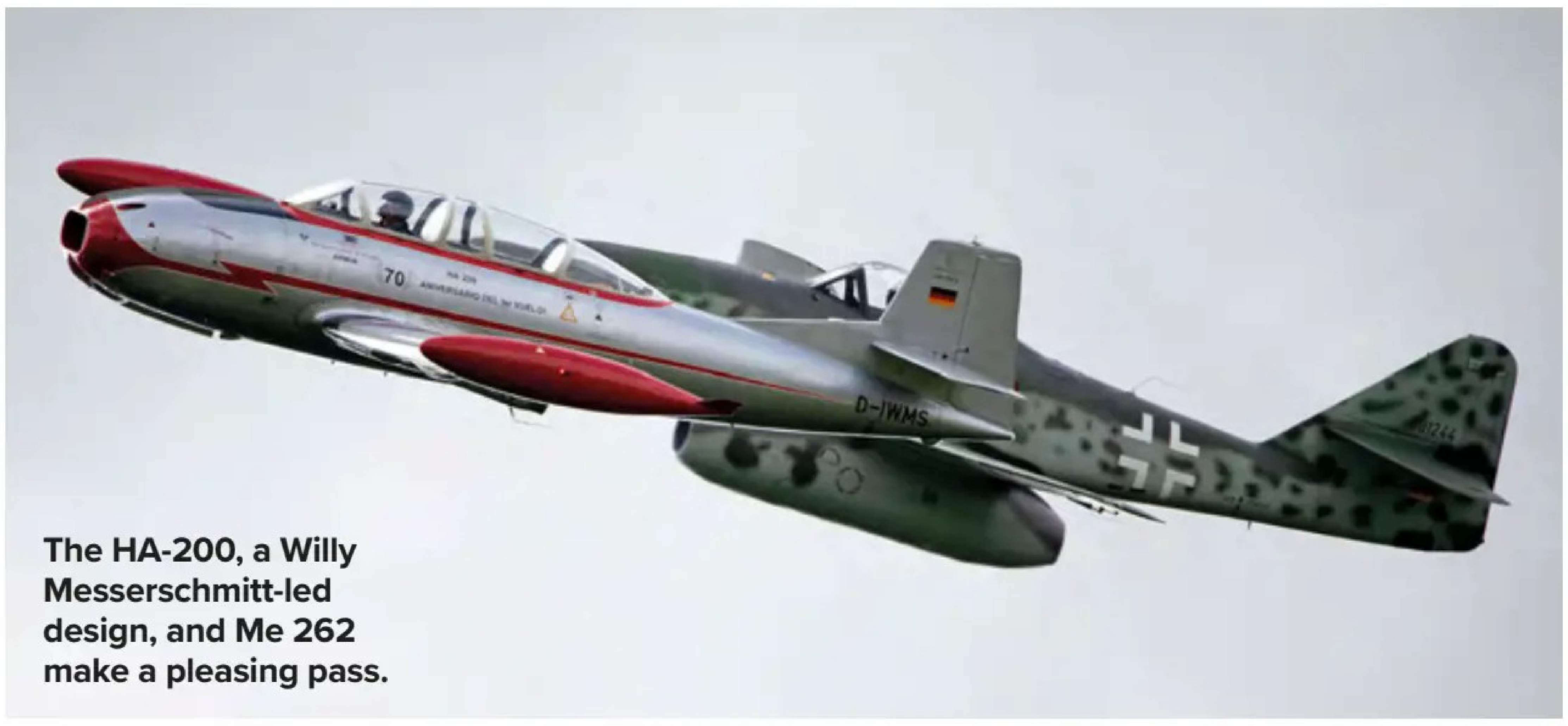
Charlie Brown tucks up the gear on Messerschmitt Bf 109 E-4 Werknummer 1983 'Red 12'.

ALL BEN DUNNELL

Sometimes in life you can have too much of a good thing. Better, often, to leave yourself wanting more. So it is with Germany's outstanding vintage aircraft occasion. This was the 20th edition of the Oldtimer Fliegertreffen at the historic Hahnweide, yet it dates back far longer than two decades. It had been six years since the previous staging, and given what a sizeable affair this combination of airshow and fly-in is, who can blame the all-volunteer organising team led by the Fliegergruppe Wolf Hirth, one of the clubs based at the all-grass gliding site south-east of Stuttgart, for needing a break?

If ever proof of the old 'absence makes the heart grow fonder' adage were needed, the sense of anticipation surrounding 2025's return to the Hahnweide — which, incidentally, requires the definite article — clearly resonated. Flightlines packed with aeroplanes from all over Europe told the story of a desire to make this one come what may, given how another imminent staging cannot be guaranteed. And any wavering resolve about journeying to this corner of the Schwäbischer Alb, amidst its characteristic wooded hills and overlooked by Burg Teck, could only have been galvanised by the presence of just about the continent's most sought-after warbird.

What finer machine could there be to witness in these surroundings than Messerschmitt Bf 109 E-4 'Red 12', not long sold by the man who commissioned its painstaking restoration, Eberhard Thiesen, to new custodian Wolfgang Landschulze, and which was here making its post-



The HA-200, a Willy Messerschmitt-led design, and Me 262 make a pleasing pass.

The Flying Bulls' P-38, P-51 and Corsair trio on majestic form.

Klaus Plasa makes a dramatic departure in FW 190 A-8/N D-FWMV.

Burg Teck looming in the background, the lovely KZ IV heads home to Stauning.

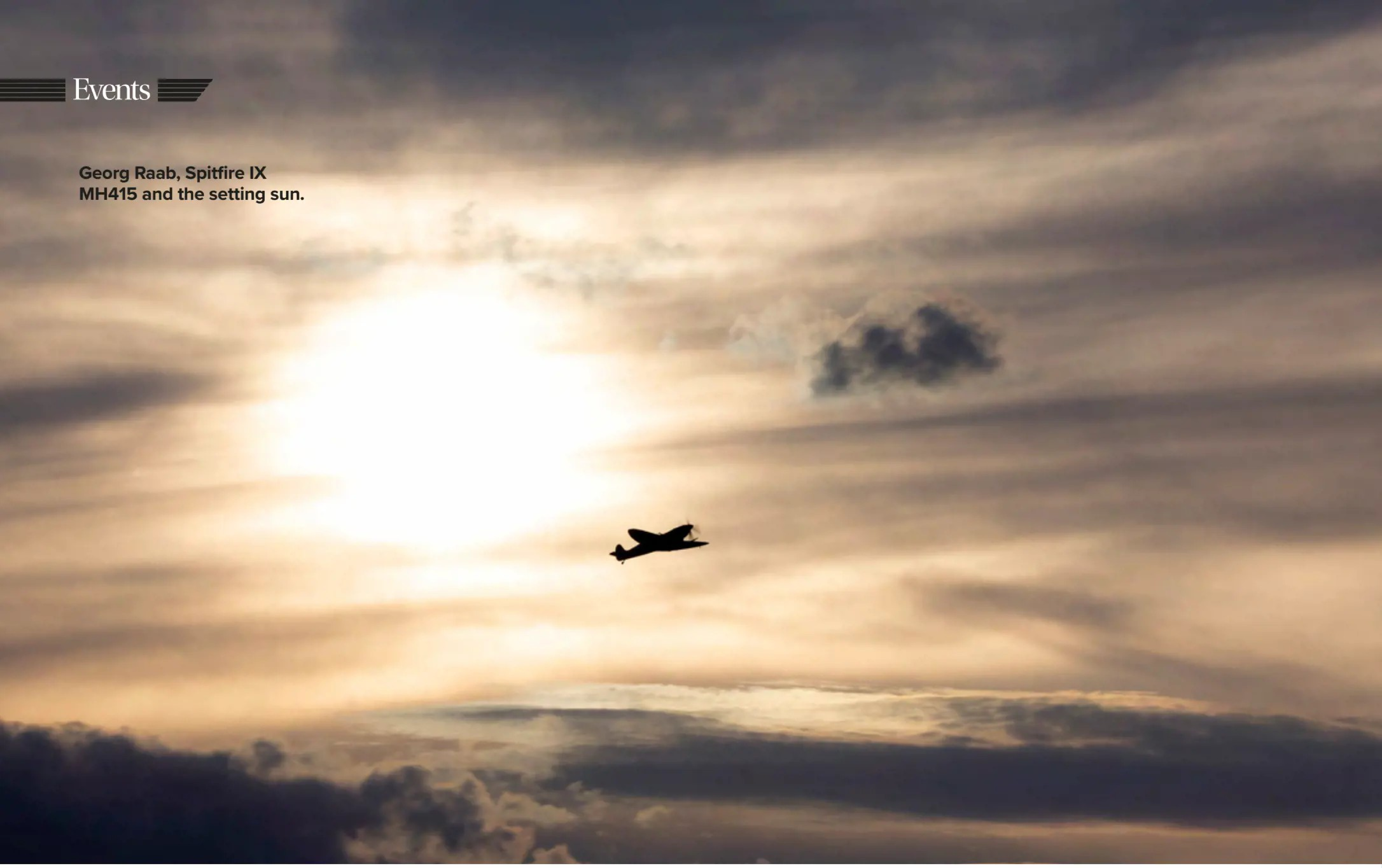
restoration airshow debut? More than that, *never* had an 'Emil' variant flown at a modern-era European display. Thankfully, the 1939-built fighter, a product of Erla Maschinenwerk in Leipzig which served with 5./JG 5 on the Eastern Front, did not disappoint.

Far from it, in fact. Charlie Brown, the man who steered 'Red 12' through its flight-testing, took the controls for a splendidly graceful routine that was not solely about the sight, but the sound too. Those of us not fortunate to have witnessed a Bf 109 E in action before could only marvel at how different the 'Emil' is when compared with any Daimler-Benz-powered variant we have seen, the note of its DB 601N engine so much less aggressive than the DB 605s of the 'Gustavs' more regularly shown. Its tone is every bit, somehow, that of an inter-war fighter. Quite properly, it was the star turn, and the many German spectators who stopped the easily recognisable Brown as he walked through the crowd to thank him for his performances were suitably appreciative.

The lion's share of the other 'heavy metal' performances came courtesy a long-established operator and a still up-and-coming collection. The Flying Bulls brought their P-38L Lightning, P-51D Mustang *Nooky Booky IV* and F4U-4 Corsair from Salzburg, Raimund Riedmann, Eric Goujon and Eskil Amdal in command for a sequence of formation aerobatics and tailchasing that makes such a mixed-type combine look effortless. From Georg Raab's Flying Legends fleet at Siegerland came another P-51D, *Frances Dell*, with Bernie Diehl at the helm, David Friedrich in the black F4U-5NL Corsair *Devotion* and its latest airworthy acquisition, Spitfire LFIX MH415, in which Raab himself flew a sublime sunset show on Saturday.

In fact a record four-strong Mustang gathering graced the Hahnweide this year, Wilhelm Heinz displaying his familiar P-51D *Louisiana Kid* and Markus Henkell adding to the static line with his more seldom-seen Australian-built CA-18, N51AB, which lives at Mainz-Finthen. Sadly another notable attendee, Braunschweig-based Flug Werk FW 190 A-8/N D-FWMV, failed to take its full place in the programme. After Klaus Plasa took off for his Saturday slot, a reported undercarriage indicator fault led to a precautionary landing, and all he could do the following afternoon was depart, gear down. But the only participating jets, the Messerschmitt Stiftung's Me 262 and Hispano HA-200 Saeta, made up for that, Tom Braun and Geri Krähenbühl putting them through their paces notably low and close — more so, indeed, than some of the lighter acts.

There was a special duty for the Flying Bulls' Harvard to carry out, as it joined two other examples of the type in a 'missing



Georg Raab, Spitfire IX MH415 and the setting sun.

ABOVE: It was a joy to see the D26 and MS317 perambulating.

BELOW: Replica Junkers F 13s head out for one of their many pleasure flights.

man' tribute to its former owner Walter Eichhorn, a legend of the German airshow scene, who died in May aged 88. In this and a fine solo it was flown by the Bulls' latest recruit, Nicolas Rossier, a former Swiss Air Force F/A-18 Hornet display pilot and long-time vintage aircraft enthusiast. One of the Harvards accompanying it, HB-RDN, in the hands of part-owner Florian Gygax and over from Birrfeld in Switzerland, was a one-time Swiss Air Force stablemate of the ex-Eichhorn aeroplane and carries those colours again.

Let no-one claim, though, that this is 'just' a warbird affair. Rare, often delectable, classics were everywhere one looked. The gleaming Dewoitine D26, HB-RAI, operated by the Association pour le Maintien du Patrimoine Aéronautique and paired with a fellow Lausanne resident, Morane-Saulnier MS317 HB-RAO as a charming duet of parasol-winged French-designs. The three Junkers F 13 replicas, surely the most characterful airshow pleasure-flyers around. The KZ IV from Danmarks Flymuseum, sole survivor of just two of these wartime air ambulances built, on an uncommon foray so far from Denmark. The only piston-engined Pilatus PC-6 still flying, Yetiflyers' spectacular pink-and-yellow HB-FAN, depicting the very first Porter which in 1960 made the highest-altitude landing by a fixed-wing aircraft during a Swiss Himalayas expedition. On and on the list went.

Of course the Hahnweide has its familiar favourites. Germany's oldest airworthy powered and unpowered aeroplanes, the 1927-vintage Klemm L25a VI owned by the BMW Group — complete with LED representation of the company's logo in its propeller — and a Schempp-Hirth Gö 1 Wolf from 1937 which belongs to the resident Fliegendes Museum Hahnweide, were both present, and equally charming. The Klemm was joined in the air by two later Kl 35s, while the Wolf took part in the traditional mass glider slot which filled Saturday morning's skies. Christoph Zahn was on customarily stunning form in his Habicht, and Mikael Carlson entertained royally come sundown aboard his Thulin A. It felt, even after a six-year gap, like we'd never been away.

There has probably never been more of an aficionado's air event, big and convivial in a manner typically German, welcoming the faithful from far and wide. The sight in the audience of T-shirts from British events like Duxford and Sleapkosh, or RIAT caps, bore witness to its pull. So too did a sell-out crowd on Saturday, which — like Sunday's ain and consequent quagmire — caused a few issues. But let nothing detract from the fact that this was a genuine classic of a show, one that simply could not be missed.

And *if* the organisers decide to hold another, the same will be true then. Time will tell as to their intentions. But whatever they might be, 2025 was testament to the love so many have for the Hahnweide, and how it in turn exudes the sheer joy of historic aviation like nowhere else.

Ben Dunnell

IWM Duxford Battle of Britain Air Show

6-7
SEPT

If there is now to be only one annual airshow that commemorates the Battle of Britain at the appropriate point in the calendar, then for that show to be at Duxford could not be more fitting. And in marking the 85th anniversary of the battle, the 2025 event achieved something which had long been awaited.

The loss in March of the last of Churchill's ‘Few’, Gp Capt John ‘Paddy’ Hemingway, was the catalyst. Hemingway flew Hurricanes with No 85 Squadron during the summer of 1940, and it was decided to gather as many airworthy examples of Hawker's fighter as could be mustered, hoping to exceed the six-year-old record for the preservation age. With an eventual eight, that mark was indeed beaten.

One of those ‘only at Duxford’ performances ensued. In the lead was the unique two-seat MkXII, ‘BE505’, operated by Hurricane Heritage and flown by Mike Collett. The bulk of the formation consisted of MkIs, with Hurricane 501's V7497, Fighter Aviation Engineering's P2902, Jennifer Taylor's P3717 and R4118 of Hurricane Heritage joined by an overseas guest, P3351, having a debut British outing in the ownership of the Letecké Muzeum Tocná in the Czech Republic. It's in the markings of No 310 (Czechoslovak) Squadron, based at Duxford in the Battle of Britain, to boot. The Biggin Hill Heritage Hangar contributed its MkX, AE977, while the Historic Aircraft Collection's MkXII was returning after replacement of its rudder.

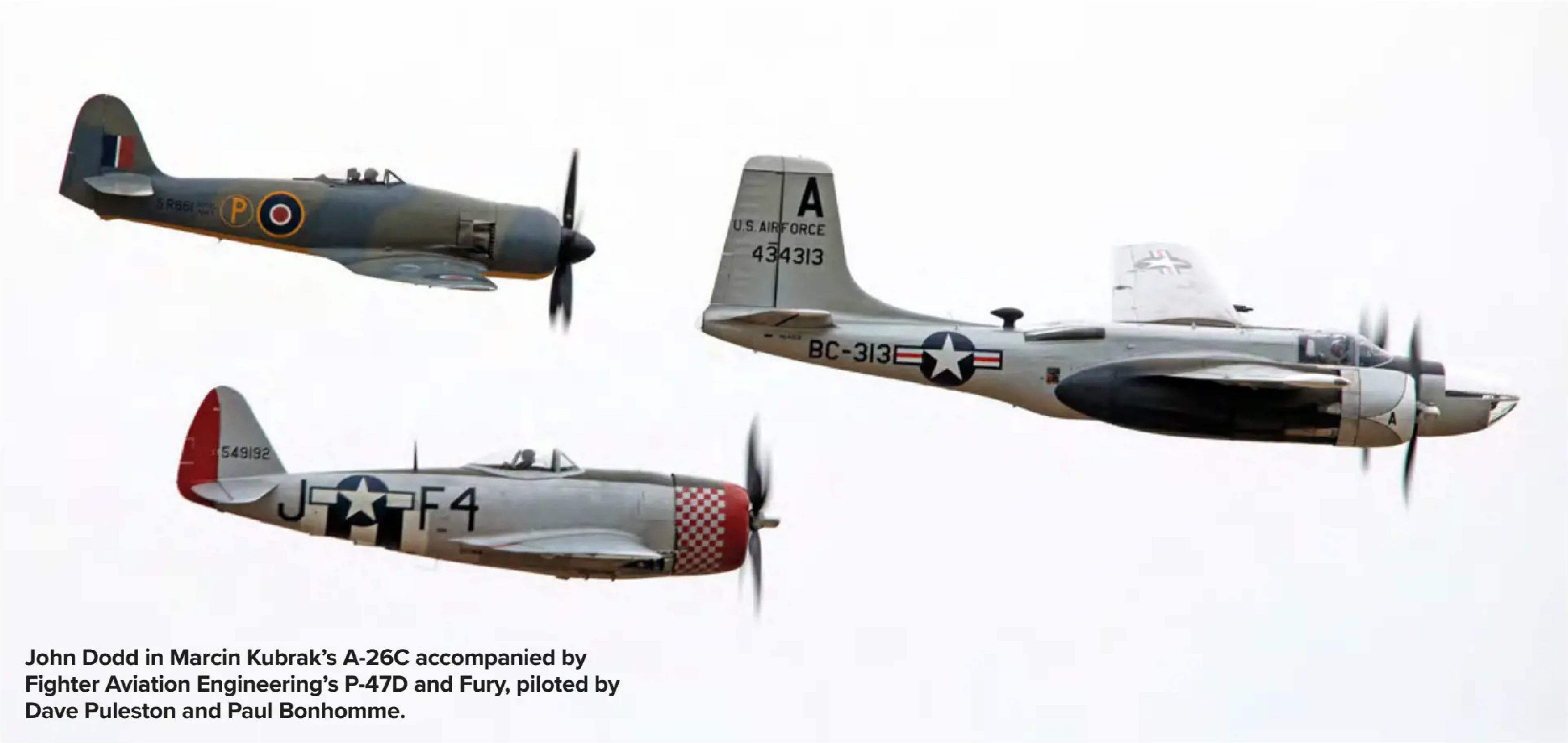
Richard Santus lifts the Anson I off Duxford's grass.

Watched by ‘Paddy’ Hemingway's son Brian, the Hurricanes flew past as an eight-ship and broke for a gentle tailchase, an especially dignified memorial in keeping with the aeroplanes. The higher-octane spectacle could come later. These were moments for quieter reflection.

Overseas involvement was very high, creating a line-up from the top drawer. Polish owner Marcin Kubrak's sleek A-26C Invader made fast, sweeping passes and gave a sparkling performance in the hands of John Dodd. Not at all what one expects from a medium bomber! The second day saw it joined by two very potent, single-engined radial warbirds from Fighter Aviation Engineering, the P-47D Thunderbolt and Fury ISS, for a trio that just oozed power.

The ‘Maritime Scenario’ brought together Plane Sailing's PBY-5A Catalina *Miss Pick* ➲

The eight Hurricanes in formation. Mike Collett, Andy Monk, Trevor Dugan, Dan Griffith, Dave Harvey, Alex Smee, Matt Pettit and James Brown were the pilots making a bit of history. ALL BEN DUNNELL

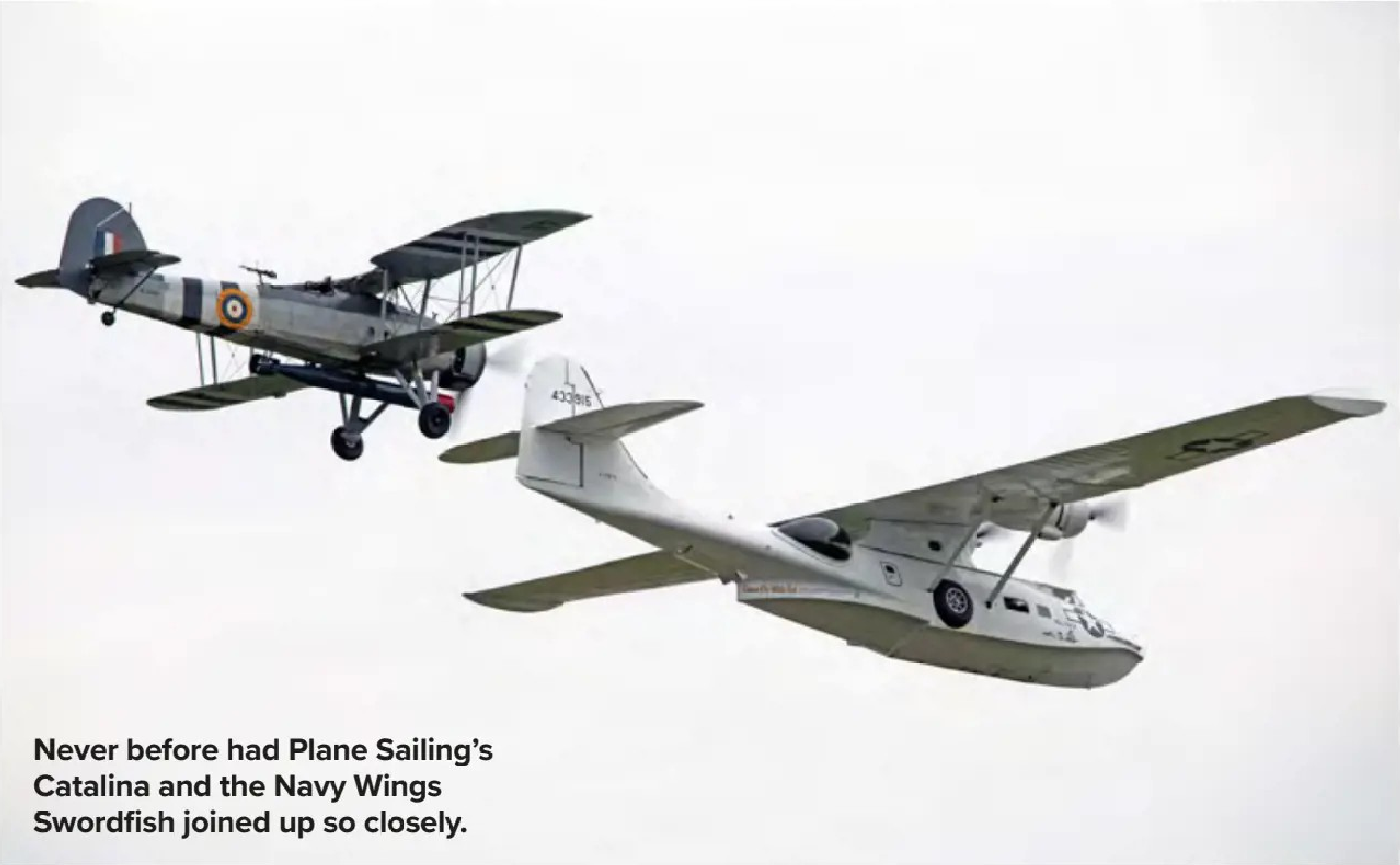

John Dodd in Marcin Kubrak's A-26C accompanied by Fighter Aviation Engineering's P-47D and Fury, piloted by Dave Puleston and Paul Bonhomme.

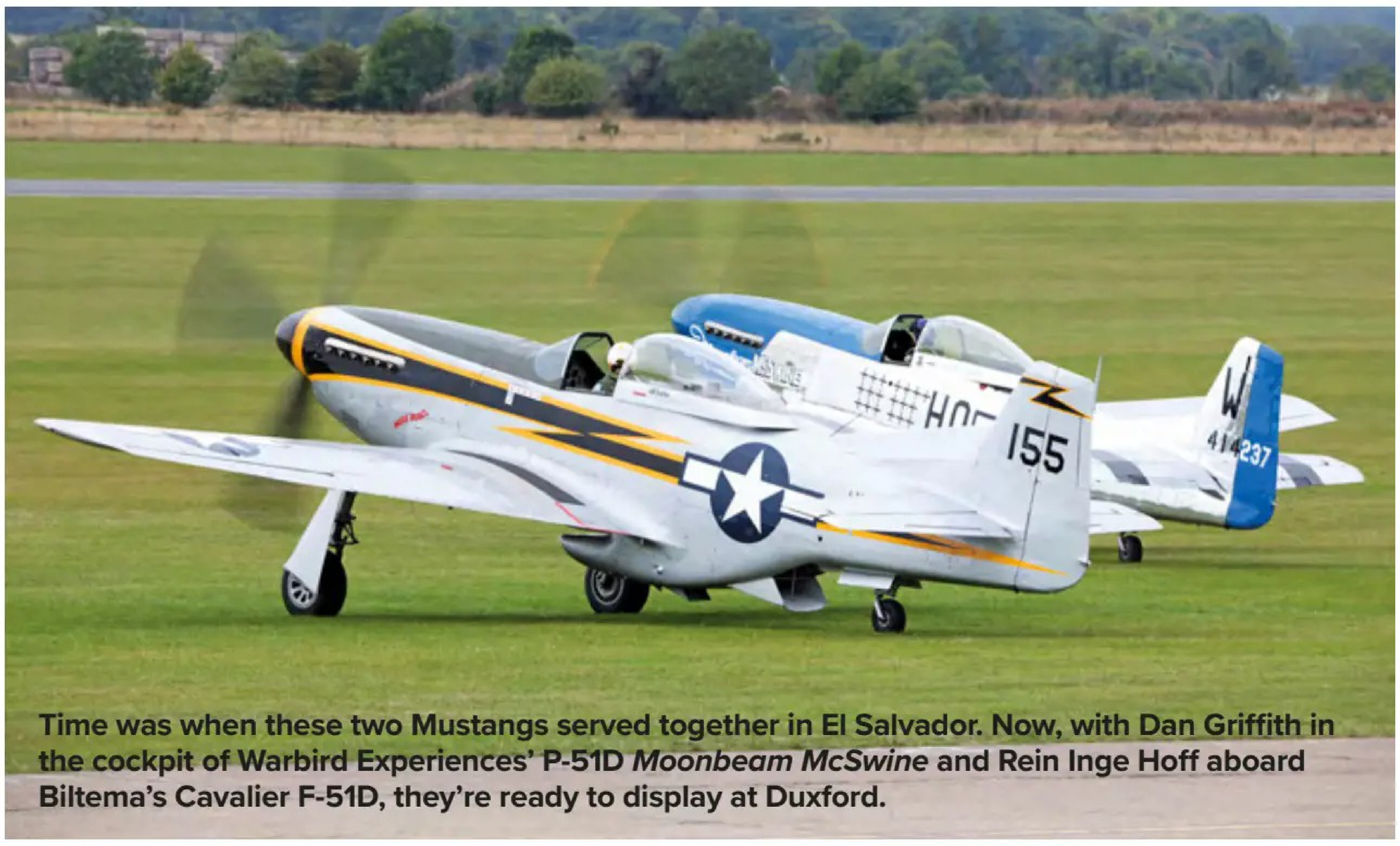
Up with Navy Wings' Swordfish W5856, for the first time making a pass in close line-astern, before each went into its individual slot. All credit to Navy Wings' Glenn Allison, who flew both days in gusty crosswind conditions which kept other vintage types on the ground. No such issues either for Remko Sijben with his CA-13 Boomerang, a type still far from familiar to British show attendees despite notching up its initial mainland appearances this summer.

The single modern-day act was an NH90 NFH helicopter from the Belgian Air Force's 40 Squadron at Koksijde, which gave a demonstration of its search and rescue capabilities by winching a 'downed pilot' from the runway. Its appearance was more than justified to honour the 28-30 (different sources record differing numbers) Belgian pilots who took part in the Battle of Britain, another reminder that not all of 'the Few' were British.

Two classic jets entertained after a loose-formation entrance: Frédéric Akary in his Sabre Mk6 and Kenneth Aarkvisla with the Norwegian Air Force Historical Squadron's Vampire FB6, the latter in RAF colours with different unit markings on each boom — No 3 Squadron's particularly apposite in this case as it also flew Canadair Sabres, and detached them to Duxford for 1953 Coronation Review practices. Akary, a born display pilot, declares the Sabre "far easier to fly than a P-51". Since the Orenda engine is near-smokeless, it is fitted with a smoke generation system.

His former mount, P-51D *Moonbeam McSwine*, was provided by its new owners, Biggin Hill-based Warbird Experiences, as part of a trio that also had Fighter Aviation Engineering's Australian-built Mustang *Jersey Jerk* and, visiting from Sola in


Never before had Plane Sailing's Catalina and the Navy Wings Swordfish joined up so closely.


Time was when these two Mustangs served together in El Salvador. Now, with Dan Griffith in the cockpit of Warbird Experiences' P-51D *Moonbeam McSwine* and Rein Inge Hoff aboard Biltema's Cavalier F-51D, they're ready to display at Duxford.

2025's Duxford 'Big Wing', the biggest yet. Biltema's Spitfire XVI, RW386, was the newcomer this time.

Norway, Biltema's Cavalier F-51D Mustang II *Miss Rebel* as a formation duo. The interesting link between both *Moonbeam* and *Miss Rebel* is that they were operated on the Salvadoran side of 1969's so-called 'Football War' between El Salvador and Honduras, scene of history's last piston-powered fighter combats.

Icing on the cake was the British debut of the quaintly named RAF Station Czechoslovakia's Anson I, which landed at Duxford on the Sunday morning inbound from Melun-Villaroche. It opened the afternoon's main programme, owner Richard Santus giving its first full display outside the Czech Republic, looking immaculate and with the Holmsley smoke system fitted to both engines. Not since November 1972, and the final flight of the Skyfame Collection aircraft, had an Anson I flown in the UK. That aircraft is now part of the IWM Duxford inventory. Perhaps one day, when the Czech machine visits again, they could be parked together?

The grand finale was, as ever, Duxford's famed 'Big Wing'. While the 15 Spitfires and seven Hurricanes (six on Sunday) disappeared into the distance to get together, the crowd was entertained in the time-honoured aerobatic manner by Steve Jones in the Buchón, on Sunday with pyrotechnic accompaniment. The formation, led by Jon Gowdy in the IWM Spitfire Ia N3200, returned to make two passes overhead before breaking to land. Its sight and sound were something that, once experienced, you're unlikely ever to forget. This was Duxford at its best.

Denis J. Calvert

What a fabulous representation of early-war RAF air power: Anson I, many Hurricanes, Blenheim and Lysander.

Air Legend

6-7 SEPT

The seventh Air Legend show at historic Melun-Villaroche airfield, 40km south of Paris, this may have been, but under the skin quite a bit had changed. It was the first edition since the passing of its co-founder Christian Amara, which had led to some uncertainty as to its future, but resulted in a new partnership with publisher and events company Éditions Larivière. Organiser Iza Bazin and her team again assembled a fascinating array of classic aviation hardware, much of which flew, sometimes in unusual formations.

There were a number of newcomers to Melun. Georg Raab's Spitfire IX MH415 came from its home in Germany, while another noteworthy participant was the immaculate P-51D *Marinell* flown by Isabel Rutland, who was of course a focus for a WASP tribute at the show. The 'Morane-Saulnier MS405' had some guessing, but was in fact the well-known Swiss F+W D-3801 in a new scheme. It was specially painted as the MS405C prototype flown by famous French test pilot Constantin 'Kostia' Rozanoff, who died at Melun when his Mystère IVB crashed in April 1954.

Laurent Calame cavorts in the newly painted D-3801.
BABAK TAGHVAEE

Air Legend's formations did not disappoint. Worthy of mention were the nice pairing of a Beech 'Staggerwing' and Spartan Executive in the Patrouille Air Deco, a sleek French Navy trio comprising Falcon 10, Zéphyr and Paris, the graceful Swiss Classic Formation of a DC-3 and three Beech 18s, now in their 19th season, a tight duo of Patrice Fiocconi's Vampire FB6 and the Top Gun Voltige CT-133, and a D-Day salute by C-47 and Spitfire MH415. The Flying Bulls' B-25J Mitchell and P-51D Mustang helped pay tribute to Christian Amara — who had owned that P-51, *Nooky Booky IV* — joined by the W Aircollection's TF-51D. Closing the airshow on each day, the classic Patrouille Tranchant with four CM170 Magisters generated memories of the teams which used to fly this type.

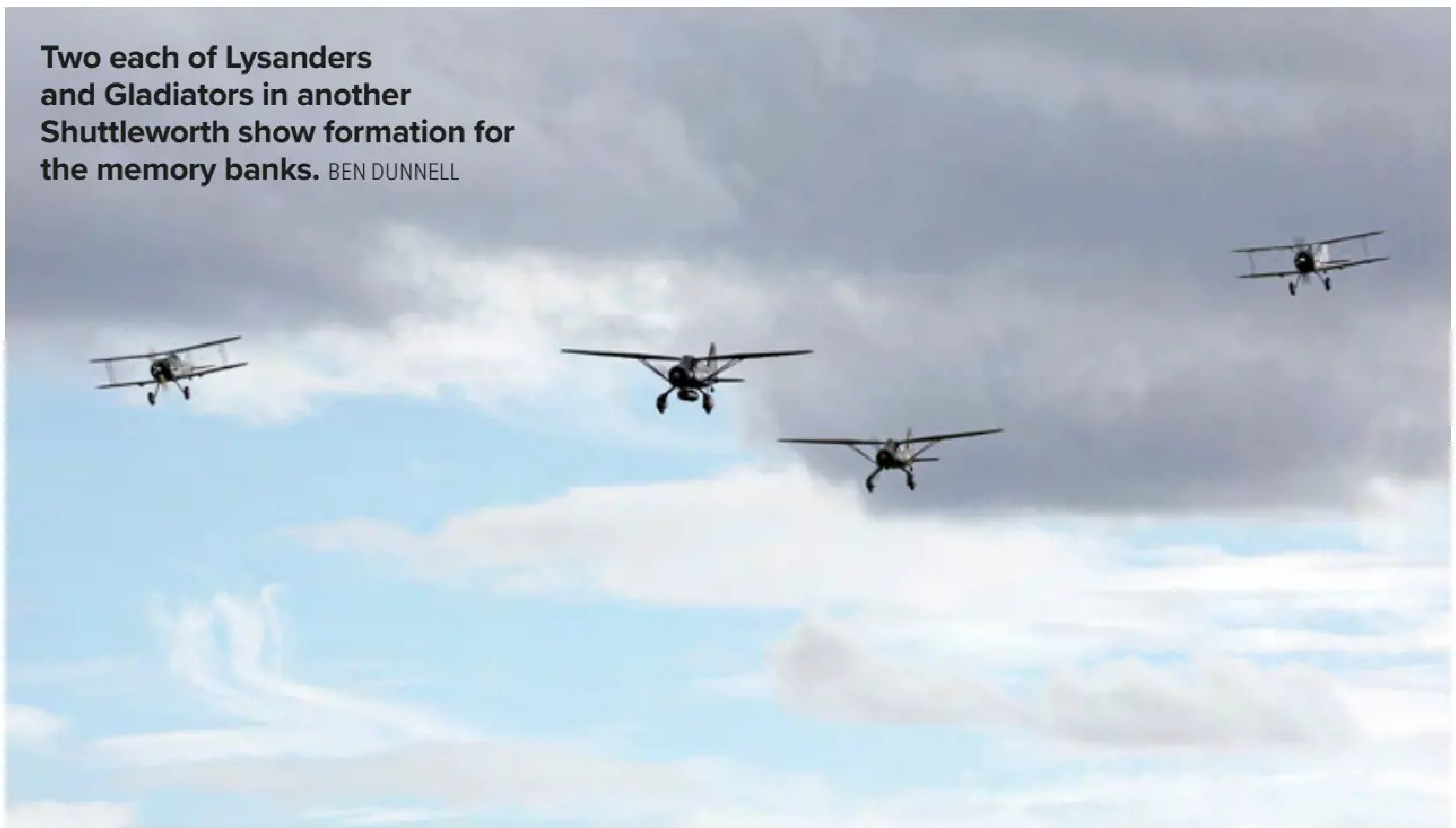
As with all warbird meetings, availability issues arise. The eagerly awaited Anson I was late leaving the Czech Republic due to weather, and then had a comms failure. It arrived too late to display on Saturday, and left early on Sunday for Duxford. On a positive note, the Me 262 returned, and was a centre of attention. While the home military participation was more army-orientated than usual, one of the most impressive displays was undoubtedly the French Air and Space Force A400M.

Mother Nature looked very kindly on the weekend, and public attendance was 26,600. Air Legend again impressed, and is a firm favourite on the warbird calendar. ***Dr Stephen Wolf***

Vampire and CT-133 flying the flag for France's classic jets.
DR STEPHEN WOLF

Shuttleworth Best of British Air Show

30 AUG


Two each of Lysanders and Gladiators in another Shuttleworth show formation for the memory banks. BEN DUNNELL

During the summer of 1985 the headline 'Whither Shuttleworth' at the front of the news section of an issue of *Aeroplane* froze me to the spot. I wasn't entirely sure what whither meant, but it didn't sound good, the story going on to clarify the financially 'existential' difficulties the Shuttleworth Collection was facing. Forty years ago, even the most sanguine reader of that chilling piece could never have imagined that, had the collection survived, a show like Best of British could ever be orchestrated.

Biggest draw of the day was a 'Mercury Four' arrangement. The Duxford-based Aircraft Restoration Company's Lysander and The Fighter Collection's Gladiator, flown by John Romain and Brian Smith respectively, joined Shuttleworth's corresponding 'Lizzie' and 'Glad', with Jean-Michel Munn and Peter Kosogorin in charge, for formation flypasts and a tailchase, the melodious soundscape courtesy of 3,400hp of Bristol radial power swirling along the crowdline in the gathering breeze.

The gusty conditions did not deter an excellent University Air Squadron centenary sequence, featuring Adam Lacey in Shuttleworth's Tiger Moth, a Chipmunk with Phil Hardisty at the helm, and Tom Turner in Skysmart MRO's Bulldog. Historic jets have become a rare sight at shows, so Kenneth Aarkvisla and the Norwegian Air Force Historical Squadron Vampire FB6 offered a reminder of happier times for classic gas turbine machinery.

Later came what would, were it a medley during the BBC's Promenade Concert season, no doubt be titled 'Westland Ho!' Sadly, a Lynx and Wasp that had been scheduled to attend for a Westland sextet couldn't make it, but a slightly slimmed-down quartet featured Shuttleworth's Spitfire Vc, AR501 — manufactured by Westland at Yeovil during 1942 and flown here by Paul Shakespeare — plus two Westland-built Gazelles, piloted by Richard Mitchell and Andy Usher from the Hampshire-based Gazelle Squadron, and the Shuttleworth Lysander, now with 'Willy' Hackett at the controls. A never-before-seen coda came from the latter three aircraft, the Lysander leading a vic before landing on, serene and swan-like, as the two Gazelles continued on their way before breaking into the circuit: magical.

Shakespeare remained airborne in AR501 for the final act, a tailchase with the Old Flying Machine Company's immortal Spitfire IX. MH434 took off with Stu Goldspink in the saddle just before the rain arrived, splitting the difference between the BBC and Met Office forecasts by starting at 16.30. But the conditions weren't to inhibit the two Shuttleworth pilots, the vigorous passes bringing the show to an energetic conclusion. And anyway, how could a Best of British show worthy of the name pass without the opportunity to thumb our noses in the direction of meteorological adversity?

Or, to paraphrase a well-known East Anglian farmer in one of our favourite aviation films, "Whither my a*se."

Tony Harmsworth

The Shuttleworth Lysander receiving fellow Westland escort from ex-QinetiQ Gazelle HT2 XZ939. BEN DUNNELL

Watches

Keep good time in style with this array of the latest timepieces

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Christopher Ward C65 Cranwell

Christopher Ward proclaims itself to now be Britain's largest watch brand, combining "Swiss mechanical excellence with English design and accessible pricing". It has an extensive Military Collection, including models for the navy, army, marines, paras and the RAF. The C65 Cranwell is named after the RAF College Cranwell, and "is a vintage-inspired pilot's watch that pays tribute to the generations of airmen trained there since 1920". Licensed by the Ministry of Defence, the RAF's heraldic badge is stamped into the case-back.

The stainless-steel case measures 38mm, and alongside the bold numerals and luminous markers on the dial it incorporates an inverted triangle at 12 o'clock recalling 20th century service watches from IWC and Jaeger-LeCoultre. Power comes from a Swiss movement, accurate to within a few seconds per day, and it's water-resistant to 150m.

Prices: from £945
Information and ordering:
www.christopherward.com

Focke-Wulf

The name of Focke-Wulf, already so well-known in aviation, is now associated with a range of high-quality watches. There are two aviation watches, the Würger Black (Interceptor) and Flieger III (Tachymeter), a pilot's watch, the Würger II (Fighter), and a dive watch, the Marinejäger (Naval Hunter), which is shown above.

Focke-Wulf's watch models often feature sapphire crystal glass and high-grade stainless steel cases, and incorporate Swiss movements — quartz or automatic, depending on the watch. The dials of the aviation and pilot's watches borrow design features from classic cockpit instruments, such as their large numerals, high-contrast hands and subtle luminescence, which makes for high readability in all conditions. Care has been paid, the company says, to achieving "authentic design without overdoing the pilot watch aesthetic", mixing vintage and modern styles — and with a standard of fit and finish belied by the price. The leather straps are comfortable for all-day wear.

Bear in mind, though, that Focke-Wulf watches are often released in limited batches, which can make getting your hands on one a challenge.

Prices: Flieger III and Würger Black £289, Würger II £299, Marinejäger £899
Information and ordering: www.fockewulf-watches.com

The Flyer Watch Company

A lengthy passion for aviation underpins the Flyer Watch Company, a British, family-owned watch brand with in excess of 25 years of experience in the industry.

Its flagship is the Altitude Automatic range, called "a modern take on the classic pilot's watch". The Altitude has a 40mm stainless steel case, sapphire-coated glass, luminous hands and markers, and 100m water-resistance. It's available in navy, green and black. A "more contemporary expression of aviation passion" comes from the AvGeek range, with precise chronograph functionality, 38mm cases, luminous detailing, a date display and 100m water-resistance. These watches come in black, navy, red, green and mint.

Prices: Altitude £329, AvGeek £199
Information and ordering:
www.flyerwatches.com

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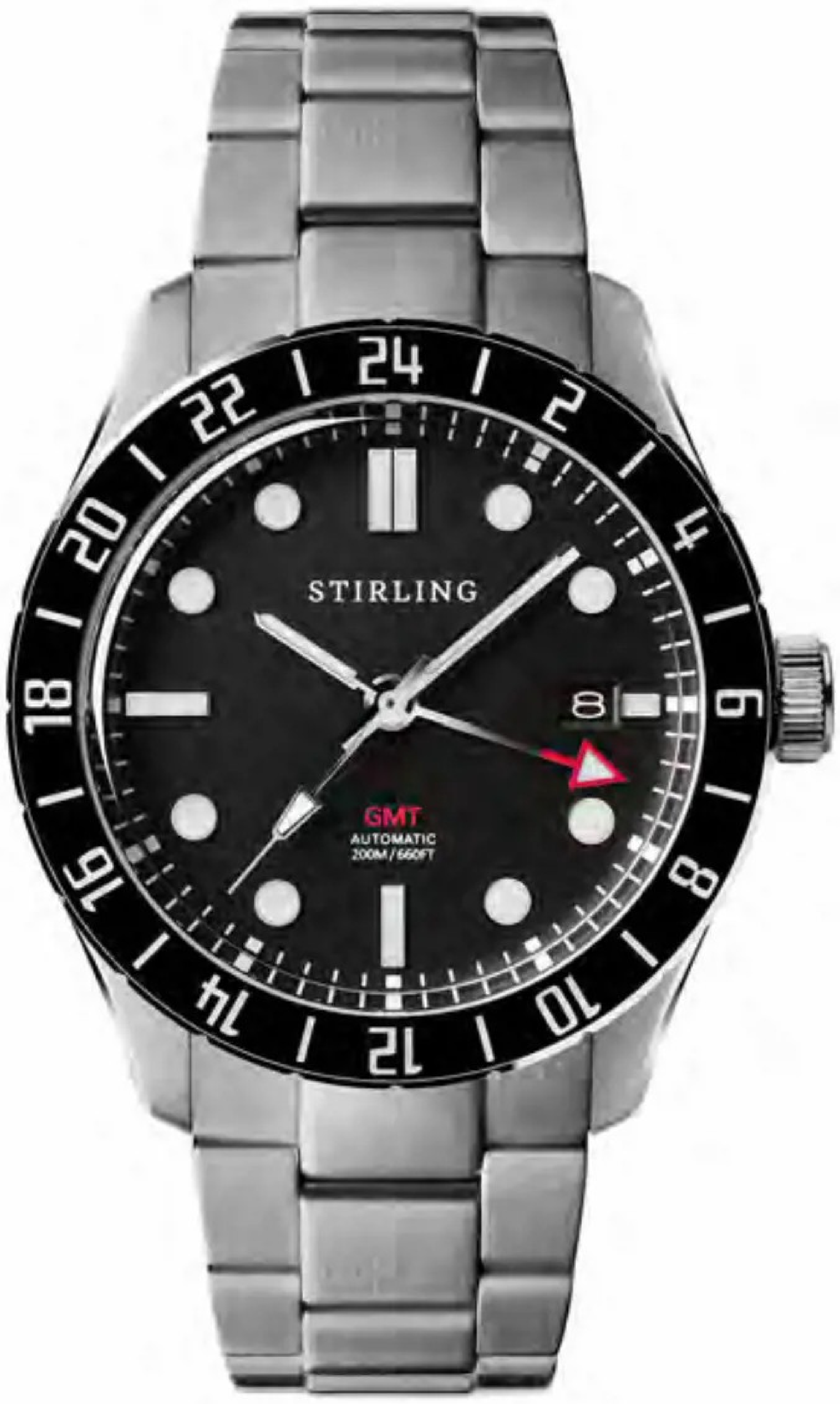


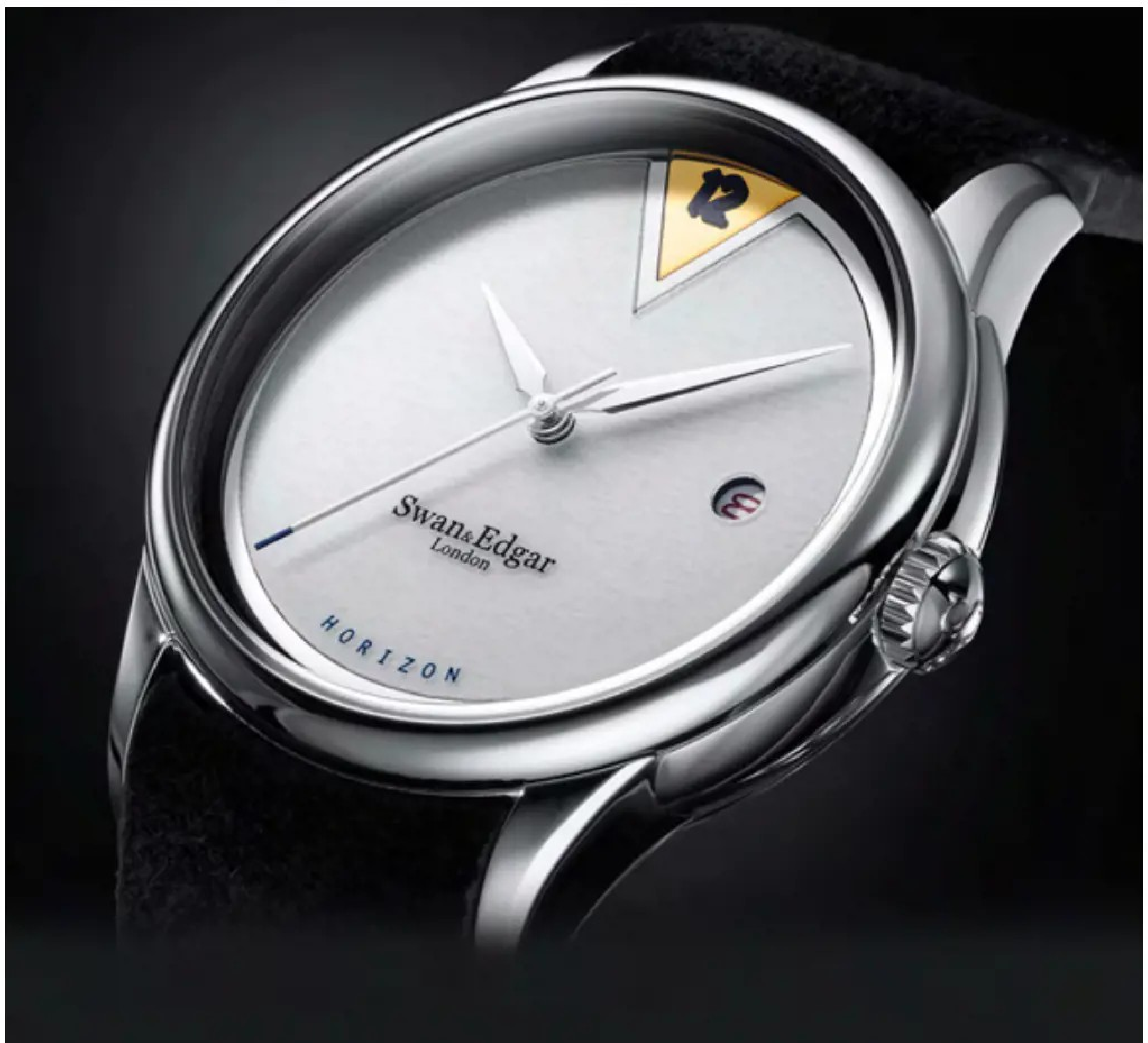
Stirling Timepieces Durrant

Founded by a serving soldier, Stirling Timepieces aims to create watches able to withstand the realities of modern operations. The Durrant, according to its wording, is "a tool watch built for resilience, clarity, and reliability in the field."

An aim with the black-and-white dial is to offer high legibility in all conditions. The count-up bezel tracks elapsed time, while the 316L steel case and screw-down crown are designed to be robust in all environments, the priorities being "precision, durability, and function above all else."

Stirling Timepieces donates a portion of proceeds from every watch sold to military and veteran charities.

Prices, information and ordering: stirlingtimepieces.com

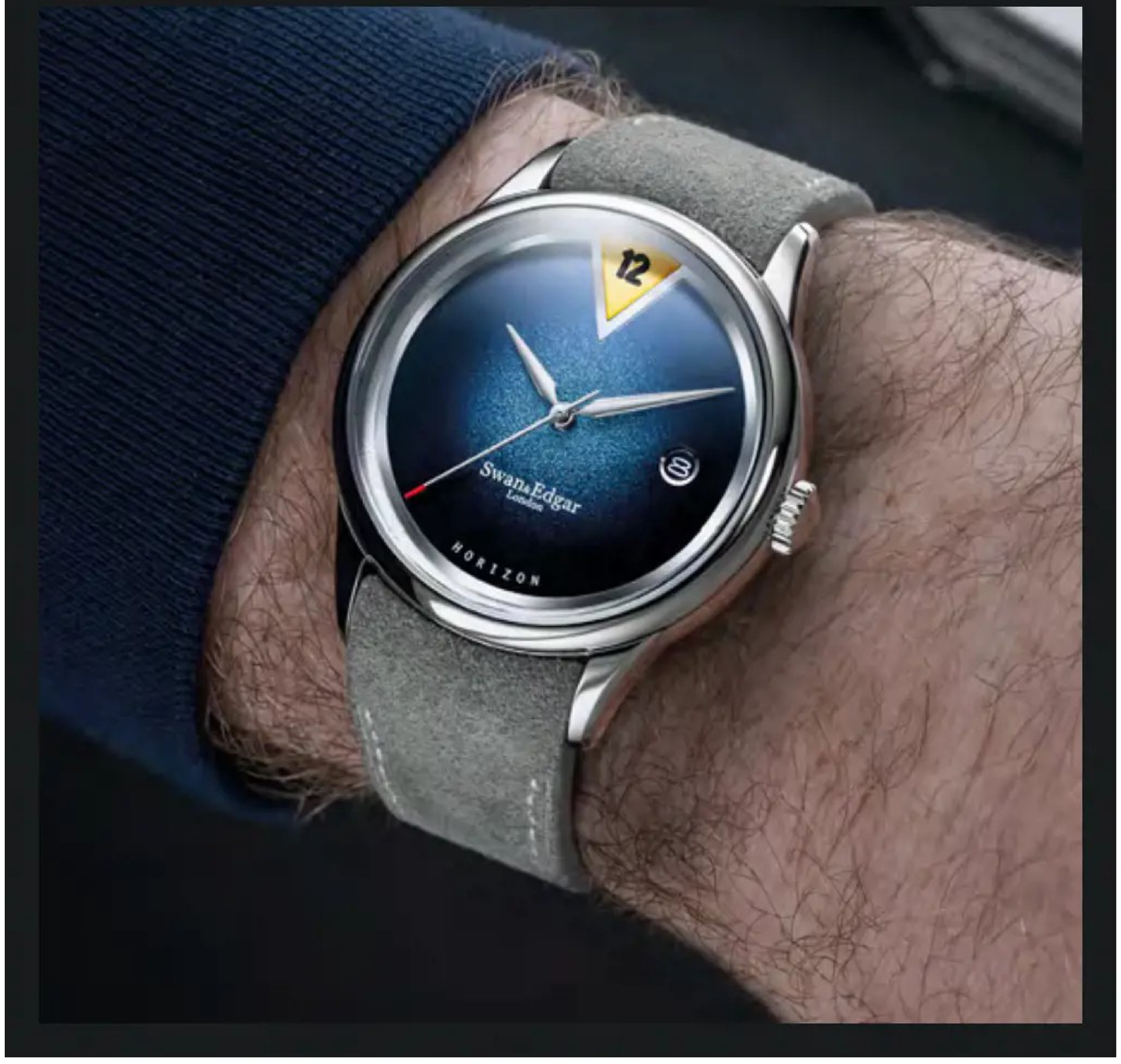


Swan & Edgar Horizon Collection

New from Swan & Edgar is the Horizon Collection, which is inspired by the White Cliffs of Dover. British-assembled, the launch quantity of the watches is limited to 300 pieces.

The Horizon Collection pays tribute to the history of the White Cliffs in relation to the Battle of Britain through "subtle RAF-inspired details", such as the golden triangle at 12 o'clock and the numeral design. There are two watches within the range: the Blue Enamel Horizon with kiln-fired fumé enamel dial "that evokes the shifting blues of sea and sky", and the Mineral Musou Horizon, which "showcases a natural white quartz dial set over a base that absorbs almost all visible light, creating a striking floating effect". Made using 316L stainless steel with a double-domed sapphire crystal, the Horizon also has an integrated Italian suede leather strap.

Prices, information and ordering: swanandedgar.com



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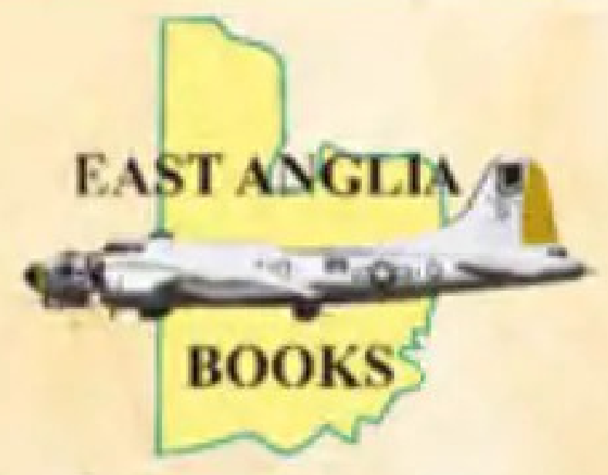

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THE HEATHROW AIRCRAFT ENTHUSIASTS FAIR returns on Sunday 16th November 10.30 / 15.00. Kempton Park Racecourse, Staines Rd East, Sunbury-On-Thames, TW16 5AQ. 07903848726
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TRANSPORT COMMAND

KEY COLLECTION

THE RAF'S FIRST VC10s

How Vickers' airliner was procured for the air force

VIA JAN FORSGREN

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SAAB 105

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